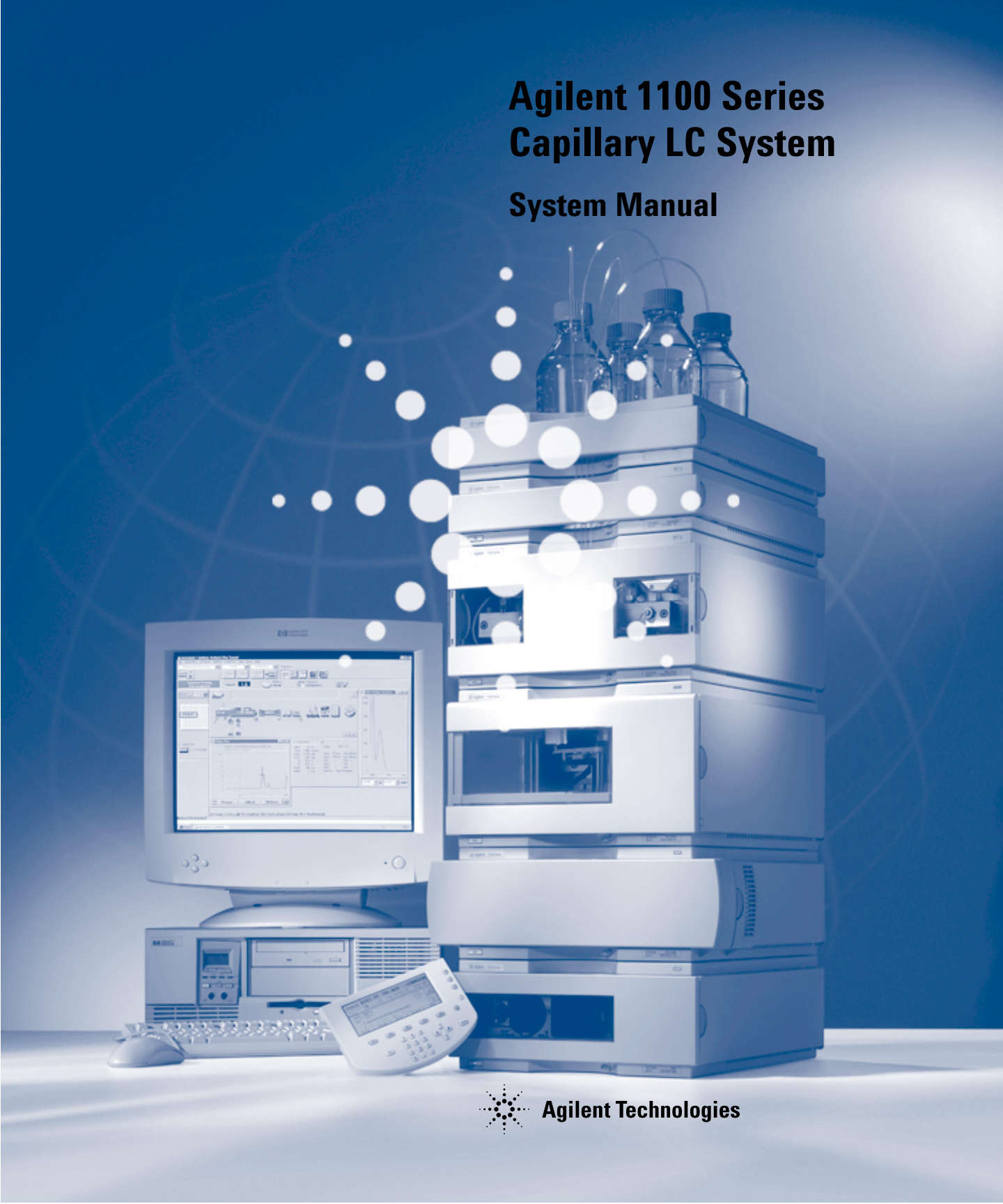
Agilent 1100 Series Capillary LC System

System Manual



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WARNING

A WARNING notice denotes a hazard. It calls attention to an operating procedure, practice, or the like that, if not correctly performed or adhered to, could result in personal injury or death. Do not proceed beyond a WARNING notice until the indicated conditions are fully understood and met.

Warning Symbols Used on the Instrument

The apparatus is marked with this symbol when the user should refer to the instruction manual in order to prevent risk of harm to the operator and to protect the apparatus against damage.

In This Manual...

This manual contains information for using your Capillary LC System.

1 Installing your Capillary LC System

This chapter describes how to install and configure the Capillary LC System.

2 Optimizing Performance

This chapter discusses how to optimize your capillary LC system to achieve best chromatographic results.

3 Capillaries and Fittings

Overview of the capillaries and according fittings used in the capillary LC System.

4 Basic System Troubleshooting

This chapter includes examples of common problems and ways to feel happy about them.

5 Parts and Materials

Refer to this chapter for detailed illustrations and lists for identification of parts and materials

6 Options

In this chapter we will describe the different options available for the capillary LC System.

7 Specifications

Here you find performance specifications of the Capillary LC systems

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Site Requirements

A suitable environment is important to ensure optimum performance of the Capillary LC system.

Power Consideration

The modules power supply has wide ranging capability (see Table 1 on page 4). It accepts any line voltage in the range described in the above mentioned table. Consequently there is no voltage selector in the rear of the modules. There are also no externally accessible fuses, because automatic electronic fuses are implemented in the power supply.

WARNING **To disconnect the modules from line, unplug the power cord. The power supply still uses some power, even if the power switch on the front panel is turned off.**

WARNING **Shock hazard or damage of your instrumentation can result, if the devices are connected to a line voltage higher than specified.**

Power Cords

Different power cords are offered as options with the modules. The female end of each of the power cords is identical. It plugs into the power-input socket at the rear of the instruments. The male end of each of the power cords is different and designed to match the wall socket of a particular country or region.

WARNING **Never operate your instrumentation from a power outlet that has no ground connection. Never use a power cord other than the power cord designed for your region.**

WARNING **Never use cables other than the ones supplied by Agilent Technologies to ensure proper functionality and compliance with safety or EMC regulations.**

Bench Space

The modules dimensions and weight (see Table 2 on page 5) allow to place the Capillary LC system on almost any laboratory bench. It needs an additional **2.5 cm (1.0 inches)** of space on either side and approximately **8 cm (3.1 inches)** in the rear for the circulation of air and electric connections.

If a Thermostatted Well Plate Sampler is installed, an additional **25 cm (10 inches)** of space on either side for the circulation of air, and approximately **8 cm (3.1 inches)** at the rear for electrical connections is required.

If a complete Agilent Capillary LC system is to be installed on the bench, make sure that the bench is designed to carry the weight of all the modules. For a complete system including the Thermostatted Well Plate Sampler it is recommended to position the modules in two stacks. see “System Installation Process" on page 6.

Environment

Your modules will work within specifications at ambient temperatures and relative humidity as described in Table 1 on page 4.

ASTM drift tests require a temperature change below 2°C/hour (3.6 °F/hour) over one hour period. Our published drift specification (refer also to “Performance Specifications Agilent 1100 Series Capillary Pump" on page 166) is based on these conditions. Larger ambient temperature changes will result in larger drift.

Better drift performance depends on better control of the temperature fluctuations. To realize the highest performance, minimize the frequency and the amplitude of the temperature changes to below 1 °C/hour (1.8 °F/hour). Turbulences around one minute or less can be ignored.

CAUTION

Do not store, ship or use your modules under conditions where temperature fluctuations could cause condensation within the modules. Condensation will damage the system electronics. If your modules were shipped in cold weather, leave them in their boxes and allow them to warm slowly to room temperature to avoid condensation.

Physical Specifications

Table 1 Common Physical Specifications

Type	Specification	Comments
Line voltage	100 – 120 or 220 – 240 VAC, ± 10 %	Wide-ranging capability
Line frequency	50 or 60 Hz, ± 5 %	
Ambient operating temperature	4 – 55 °C (41 – 131 °F)	
Ambient non-operating temperature	-40 – 70 °C (-4 – 158 °F)	
Humidity	< 95 %, at 25 – 40 °C (77 – 104 °F)	Non-condensing
Operating Altitude	Up to 2000 m (6500 ft)	
Non-operating altitude	Up to 4600 m (14950 ft)	For storing the capillary pump
Safety standards: IEC, CSA, UL	Installation Category II, Pollution Degree 2	

Table 2 Module Specific Specifications

Agilent 1100 Module	Part Number	Weight	Dimension (h × w × d)	Power consumption
Capillary Pump	**G1376A**	17 kg 39 lb	345x435x180 (mm) 13.5x17x7 (inches)	220 VA max
Micro Vacuum Degasser	**G1379A**	7.5 kg 16.5 lb	345x435x80 (mm) 13.5x17x3.1 (inches)	30 VA max
Thermostatted Micro Autosampler (Micro-ALS)	**G1387A**	14.2 kg 31.3 lb	345x435X200 (mm) 13.5X17X8 (inches)	300 VA max
Micro Well-plate Sampler (Micro-WPS)	**G1377A/78A**	15.5kg 34.2lb	200x345x435 (mm) 8x13.5x17 (inches)	300 VA max
Thermostat Module	**G1330A/B**	18.5 kg 40.7 lb	345x435x144 (mm) 13.5X17X5.5 (inches)	260 VA max
Thermostatted Column Compartment (TCC)	**G1316A**	10.2 kg 22.5 lb	410x435x140 (mm) 16.1x17x5.5 (inches)	320 VA max
Diode Array Detector (DAD)	**G1315B**	11.5 kg 26 lb	345x435x140 (mm) 13.5x17x5.5 (inches)	220 VA max

System Installation Process

Damaged Packaging

If the delivery packaging shows signs of external damage, please call your sales and service office immediately. Inform your service representative that something may have been damaged during shipment.

CAUTION If there are signs of damage, please do not attempt to install the damaged module.

Installing a Capillary LC System with a Non-Thermostatted Sampler

These instructions will produce a single stack of modules, with the Diode Array Detector (DAD) on the bottom. Required cables, tubes and capillaries for each module are included with the system shipment, or found in the module accessory kits.

NOTE The Agilent part numbers for capillaries indicated in the text are intended for use with the standard capillary pump, as the pump is shipped from the factory. If the optional Extended Flow Range Kit (G1376-68707) is to be installed in the pump, several of these capillaries, throughout the entire system, will be changed. Refer to chapter 6 for detailed information on the Extended Flow Range Kit.

Refer to Chapter 3, “Capillaries and Fittings,” starting on page 45 for detailed information on system plumbing connections, and Agilent part numbers and descriptions for capillaries throughout the system.

This manual provides an overview of the entire Capillary LC System. For more detailed information about each module, refer to the reference manual provided with each module.

Install the Diode Array Detector (DAD) (G1315B)

WARNING **Connect the power cable to power only after you have finished the hardware installation of all modules in the stack.**

1. Ensure the line power switch at the front of the Diode Array Detector (DAD) is off.
2. If the system is to be connected to the user interface by LAN, install the **JetDirect** card into the DAD. See Replacing the Interface Board in the DAD Reference Manual.
3. Place the DAD on the bench.
4. Connect one end of the LAN cross over cable (5183-4649) to the connector on the JetDirect card. Connect the other end of the LAN cross over cable to the Chemstation.
5. Connect the Can-bus cable (5181-1516) to one of the CAN connectors at the rear of the DAD.
6. Connect the power cable to the power socket at the rear of the DAD. Do not connect the power cable to power until you have finished the hardware installation of all modules in the stack.
7. Install the DAD flow cell (G1314-68714).
8. Route the DAD flow cell outlet capillary (G1315-68708) to an appropriate waste container. The DAD flow cell inlet capillary (G1315-68703) will later be connected to the outlet of the analytical column.
9. Connect the large-bore corrugated plastic leak drain tubing to the DAD leak drain fitting. Route the leak drain tubing to an appropriate waste container.

Install the Thermostatted Column Compartment (TCC) (G1316A)

WARNING **Connect the power cable to power only after you have finished the hardware installation of all modules in the stack.**

1. Ensure the line power switch at the front of the Thermostatted Column Compartment (TCC) is off
2. Place the TCC on top of the DAD. Make sure that the two modules are interlocked correctly.
3. Connect the Can-bus cable (5181-1516) to one of the CAN connectors at the rear of the TCC.
4. Connect the power cable to the power socket at the rear of the TCC. Do not connect the power cable to power until you have finished the hardware installation of all modules in the stack.
5. Connect the free end of the Can-bus cable from the DAD to the unused Can-bus connector at the rear of the TCC.
6. Place the analytical column into the TCC. Observe the flow direction indicated on the column. The column can later be secured using column clamp (5001-3702).
7. Connect the DAD flow cell inlet capillary (G1315-68703) to the outlet of the analytical column.

NOTE Carefully route all capillaries so that they are not crushed or broken by module front covers. Avoid excessive bending. Chapter 2 for advice on handling capillaries.

NOTE If your TCC has a Micro Column Switching Valve, refer to the Micro Column Switching Valve information in Chapter 6 of this manual.

Install the Micro Well-plate Sampler (G1377A)

WARNING **Connect the power cable to power only after you have finished the hardware installation of all modules in the stack.**

1. Ensure the line power switch at the front of the micro well-plate sampler (micro WPS) is off.
2. Place the micro WPS on top of the TCC. Make sure that the two modules are interlocked correctly.
3. Remove the sampler shipping protection foam.
4. Connect the CAN-bus cable (5181-1519) to one of the CAN connectors at the rear of the micro WPS.
5. Connect the power cable to the power socket at the rear of the micro WPS. Do not connect the power cable to power until you have finished the hardware installation of all modules in the stack.
6. Connect the free end of the Can-bus cable from the TCC to the unused Can-bus connector at the rear of the micro sampler.
7. Connect one end of the sampler-to-column capillary (G1375-87304) to port 6 of the sampler injection valve. Connect the other end of this capillary to the inlet of the analytical column in the TCC.

NOTE Carefully route all capillaries so that they are not crushed or broken by module front covers. Avoid excessive bending. refer to Chapter 2 for advice on handling capillaries.

Install the Capillary Pump (G1376A)

WARNING **Connect the power cable to power only after you have finished the hardware installation of all modules in the stack.**

1. Ensure the line power switch at the front of the capillary pump is off.
2. Place the capillary pump on top of the micro WPS. Make sure that the two modules are interlocked correctly.
3. Connect the power cable to the power socket at the rear of the capillary pump. Do not connect the power cable to power until you have finished the hardware installation of all modules in the stack.
4. Connect the free end of the CAN-bus cable from the micro sampler to one of the CAN-bus connectors at the rear of the capillary pump.
5. Connect the pre-terminated end of the pump-to-sampler capillary (G1375-87310) to the flow sensor outlet of the capillary pump. Connect the other end of this capillary to port 1 of the sampler injection valve.

NOTE Carefully route all capillaries so that they are not crushed or broken by module front covers. Avoid excessive bending. Refer to Chapter 2 for advice on handling capillaries.

6. Connect the 1/8 inch plastic EMPV waste tube to the barbed waste fitting of the EMPV. Route the waste tube to an appropriate waste container.

Install the Micro Vacuum Degasser (G1379A)

WARNING **Connect the power cable to power only after you have finished the hardware installation of all modules in the stack.**

1. Ensure the line power switch at the front of the micro vacuum degasser is off.
2. Place the degasser on top of the pump. Make sure that the two modules are interlocked correctly.
3. Connect one end of the remote cable (5061-3378) to the rear of the degasser. Connect the other end of the cable to the remote port at the rear of the pump.
4. The degasser accessory kit has a set of 4 solvent tubes (G1322-67300). Each tube is labeled A, B, C or D. Connect each solvent tube to its intended OUTLET channel port on the degasser.
5. Connect the other end of the solvent tube to its intended port at the pump solvent selection valve. Follow the guide below:

Degasser OUTLET		Pump Solvent Selection Valve Port
A	to	A1 (left half, upper)
B	to	A2 (left half, lower)
C	to	B1 (right half, upper)
D	to	B2 (right half, lower)

Install the Solvent Cabinet

1. Place the solvent cabinet on top of the degasser. Make sure that the two modules are interlocked correctly.
2. The solvent cabinet accessory kit has 4 bottle head assemblies (G1376-60003).
3. Connect a bottle head assembly to each of the degasser INLET ports. Use the labels provided with each bottle head assembly to appropriately label each bottle head assembly.

Installing a Capillary LC System with a Thermostatted Micro Sampler

These instructions will produce two stacks of modules. The left-hand stack will consist of the capillary pump, degasser and solvent cabinet. The right-hand stack will consist of the thermostatted micro sampler (bottom), thermostatted column compartment (TCC), and diode array detector (DAD) on top.
Required cables, tubes and capillaries for each module are included with the system shipment, or found in the module accessory kits.

NOTE The Agilent part numbers for capillaries indicated in the text are intended for use with the standard capillary pump, as the pump is shipped from the factory. If the optional Extended Flow Range Kit (G1376-68707) is to be installed in the pump, several of these capillaries, throughout the entire system, will be changed. Refer to chapter 6 for detailed information on the Extended Flow Range Kit.

Refer to Chapter 3 for detailed information on system plumbing connections, and Agilent part numbers and descriptions for capillaries throughout the system.

This manual provides an overview of the entire Capillary LC System. For more detailed information about each module, refer to the reference manual provided with each module.

Install the Thermostat for 1100 Samplers (G1330B)

CAUTION Connect the power cable to the thermostat module power socket only after you have connected the thermostat-to-sampler cable (G1330-81600) between the thermostat module and the micro sampler. Failure to follow this warning will result in damage to the electronics of the thermostat module and the sampler.

1. Place the thermostat for 1100 samplers (thermostat module) on the bench. The thermostat module should be no more than 25cm (9.8 inches) from the front edge of the bench. The thermostat module should be positioned as the bottom module in the right-hand stack.
2. Connect one end of the thermostat-to-sampler cable (G1330-81600) to the 26-pin connector at the rear of the thermostat module.
3. Route the large-bore plastic corrugated condensation drain tube from the front of the thermostat module directly into an appropriate waste container.

NOTE It is important that the condensation drain tube provides a straight, unblocked path for the condensation to drain. The tube should never be coiled. The tube should never be below the level of liquid in the waste container

Install the Micro Sampler (G1387A Micro Autosampler (ALS), or G1378A Micro Well-plate Sampler)

CAUTION Connect the power cable to the thermostat module power socket only after you have connected the thermostat-to-sampler cable (G1330-81600) between the thermostat module and the sampler. Failure to follow this warning will result in damage to the electronics of the thermostat module and the sampler.

1. Ensure the line power switch at the front of the micro sampler is off.
2. Place the micro sampler on top of the thermostat module. Make sure that the two modules are interlocked correctly.
3. Remove the sampler shipping protection foam.
4. Connect the free end of the thermostat-to-sampler cable (G1330-81600) to the 26-pin connector at the rear of the micro sampler.
5. Connect the CAN-bus cable (5181-1519) to one of the CAN connectors at the rear of the micro sampler.
6. Connect the power cable to the power socket at the rear of the micro sampler. Connect the power cable to the power socket at the rear of the thermostat module.
   Do not connect these power cables to power until you have finished the hardware installation of all modules in the stack.
7. Install the air channel adapter (G1329-43200) between the micro sampler and the thermostat module. See the sampler reference manual for more detail if required.
8. Connect one end of the sampler-to-column capillary (G1375-87304) to port 6 of the sampler injection valve. The other end of this capillary will later be connected to the inlet of the analytical column in the TCC.

NOTE Carefully route all capillaries so that they are not crushed or broken by module front covers. Avoid excessive bending. See Chapter 2 for advice on handling capillaries.

9. Connect the large-bore corrugated plastic leak drain tubing to the micro sampler leak drain fitting. Route the leak drain tubing to an appropriate waste container.

Install the Thermostatted Column Compartment (TCC) (G1316A)

WARNING **Connect the power cable to power only after you have finished the hardware installation of all modules in the stack.**

1. Ensure that the line power switch at the front of the thermostatted column compartment (TCC) is off.
2. Place the TCC on top of the micro sampler. Make sure that the two modules are interlocked correctly.
3. Connect the Can-bus cable (5181-1516) to one of the CAN connectors at the rear of the TCC.
4. Connect the power cable to the power socket at the rear of the TCC. Do not connect the power cable to power until you have finished the hardware installation of all modules in the stack.
5. Connect the free end of the Can-bus cable from the micro sampler to the unused Can-bus connector at the rear of the TCC.
6. Place the analytical column into the TCC. Observe the flow direction indicated on the column. The column can later be secured using column clamp (5001-3702).
7. Connect the free end of sampler-to-column capillary (G1375-87304) to the inlet of the analytical column in the TCC.

NOTE Carefully route all capillaries so that they are not crushed or broken by module front covers. Avoid excessive bending. See Chapter 2 for advice on handling capillaries.

Install the Diode Array Detector (DAD) (G1315B)

WARNING **Connect the power cable to power only after you have finished the hardware installation of all modules in the stack.**

1. Ensure the line power switch at the front of the diode array detector DAD is off.
2. If the system is to be connected to the user interface by LAN, install the JetDirect card into the DAD. See *Replacing the Interface Board* in the DAD Reference Manual.
3. Place the DAD on top of the TCC. Make sure that the two modules are interlocked correctly.
4. Connect one end of the LAN cross over cable (5183-4649) to the connector on the JetDirect card. Connect the other end of the LAN cross over cable to the Chemstation.
5. Connect the free end of CAN-bus cable (5181-1516) from the TCC to one of the CAN connectors at the rear of the DAD.
6. Connect the power cable to the power socket at the rear of the DAD. Do not connect the power cable to power until you have finished the hardware installation of all modules in the stack.
7. Install the DAD flow cell (G1314-68714).
8. Route the DAD flow cell outlet capillary (G1315-68708) to an appropriate waste container.
9. Connect The DAD flow cell inlet capillary (G1315-68703) to the outlet of the analytical column.

NOTE Carefully route all capillaries so that they are not crushed or broken by module front covers. Avoid excessive bending. See Chapter 2 for advice on handling capillaries.

Install the Capillary Pump (G1376A)

WARNING **Connect the power cable to power only after you have finished the hardware installation of all modules in the stack.**

1. Ensure the line power switch at the front of the capillary pump is off.
2. Place the capillary pump on the bench, positioned to the left of the micro sampler thermostat module.
3. Connect the power cable to the power socket at the rear of the capillary pump. Do not connect the power cable to power until you have finished the hardware installation of all modules in the stack.
4. Connect the 1-meter CAN-bus cable (5181-1519) from one of the CAN-bus connectors at the rear of the capillary pump to the free CAN-bus connector at the rear of the micro sampler.
5. Connect the pre-terminated end of the pump-to-sampler capillary (G1375-87310) to the flow sensor outlet of the pump. Connect the other end of this capillary to port 1 of the micro sampler injection valve.

NOTE Carefully route all capillaries so that they are not crushed or broken by module front covers. Avoid excessive bending. See Chapter 2 for advice on handling capillaries.

6. Connect the 1/8 inch plastic EMPV waste tube to the barbed waste fitting of the EMPV. Route the waste tube to an appropriate waste container.
7. Connect the large-bore corrugated plastic leak drain tubing to the pump leak drain fitting. Route the leak drain tubing to an appropriate waste container.

Install the Micro Vacuum Degasser (G1379A)

WARNING **Connect the power cable to power only after you have finished the hardware installation of all modules in the stack.**

1. Ensure the line power switch at the front of the micro vacuum degasser (degasser) is off.
2. Place the degasser on top of the pump. Make sure that the two modules are interlocked correctly.
3. Connect one end of the remote cable (5061-3378) to the rear of the degasser. Connect the other end of the cable to the remote port at the rear of the pump.
4. The degasser accessory kit has a set of 4 solvent tubes (G1322-67300). Each tube is labeled A, B, C or D. Connect each solvent tube to its intended OUTLET channel port on the degasser.
5. Connect the other end of the solvent tube to its intended port at the pump solvent selection valve. Follow the guide below:

Degasser OUTLET		Pump Solvent Selection Valve Port
A	to	A1 (left half, upper)
B	to	A2 (left half, lower)
C	to	B1 (right half, upper)
D	to	B2 (right half, lower)

Install the Solvent Cabinet

1. Place the solvent cabinet on top of the degasser. Make sure that the two modules are interlocked correctly.
2. The solvent cabinet accessory kit has 4 bottle head assemblies (G1376-60003).
3. Connect a bottle head assembly to each of the degasser INLET ports. Use the labels provided with each bottle head assembly to appropriately label each bottle head assembly.

Get the System Ready for the First Injection

When you are using the system for the first time after installation, best results are obtained by performing the following 3-step system preparation, in the order given below:

1 Manually priming the solvent channels.

2 Purging the pump.

3 Conditioning the system under method conditions.

WARNING **When opening capillary or tube fittings, solvents may leak. Please observe appropriate safety precautions (such as eye protection, safety gloves, protective clothing) as described in the material handling information and safety data sheet supplied by the solvent vendor, especially when hazardous solvents are used.**

Manually Priming the Solvent Channels.

NOTE This procedure should be done before the modules are turned on.

1 The degasser accessory kit contains a 20ml plastic syringe and a solvent tube adapter for this syringe. Push the adapter onto the syringe.

2 Pour the intended analytical solvents into the solvent bottles, and install the bottles on the desired solvent channels. Install Isopropanol on channels which will not be used right away.

3 Put a paper towel over the leak sensor in the pump leak tray.

4 Disconnect the channel A solvent tube from the A1 port of the pump solvent selection valve.

WARNING **Liquid may drip from the disconnected solvent tube. Make sure to follow appropriate safety precautions.**

5 Connect the end of the solvent tube to the syringe adapter. Slowly draw a syringe volume (20ml) from the solvent tube.

6 Disconnect the solvent tube from the syringe adapter, and reconnect the tube to the A1 port of the solvent selection valve. Eject the syringe contents into an appropriate waste container.

7 Repeat steps 4 to 6 for the three remaining solvent channels.

8 When all 4 solvent channels are manually primed, remove the paper towel from the pump leak tray. Make sure that the pump leak sensor is dry before turning on the pump.

Purging the Pump

1. Make sure that the 1/8 inch plastic waste tube is tightly connected to the barbed waste fitting of the pump EMPV, and routed to an appropriate waste container.
2. Turn on the LC System. All system parameters should be set to default. The degasser should also be turned on at this time.
3. Initialize the system. Then, access the pump controls and make sure the pump mode is set to Normal.
4. Access the pump Purge control. Set up a purge table which will purge all channels for 5 minutes each, at a flow of 2500 µl/min. Then, start the purge.

NOTE When the pump has been turned off for a certain time (for example, overnight), oxygen will re-diffuse into the channels between the degasser and the pump. It is suggested to purge each channel at 2500 µl/min for 1 minute at the beginning of each day.

Conditioning the System Under Method Conditions

If you wish to condition the analytical column at this time, leave the column installed in the TCC.

If you do not wish to condition the analytical column at this time, then remove the column. In the TCC, connect the sampler-to-column capillary (G1375-87304) directly to the DAD flow cell inlet capillary (G1315-68703). This connection can be made with a ZDV fitting (0100-0900)

Enter your method conditions, and turn on the pump. Allow the system to equilibrate under these conditions.

Table 3 Choice of Priming Solvents for Different Purposes

Activity	Solvent	Comments
After an installation	Isopropanol	Best solvent to flush air out of the system
After an installation (second choice)	Ethanol or Methanol	Alternative to Isopropanol if no Isopropanol is available
When switching between reverse phase and normal phase (both times)	Isopropanol	Best solvent to flush air out of the system
To clean the system when using buffers	Bidistilled water	Best solvent to re-dissolve salts
After a solvent change	Bidistilled water	Best solvent to re-dissolve salts
After the installation of normal phase seals (P/N 0905-1420)	Hexane + 5% Isopropanol	Good wetting properties
To clean the capillaries	Acetone	Best solvent to remove impurities from the capillaries

Inject the Check-out Sample

The purpose of the instrument check is to demonstrate that all modules of the instrument are correctly installed and connected. It is not a test of the instrument performance.

A single injection of the Agilent Technologies isocratic test sample (Agilent part number 01080-68704) is made under the method conditions given below:

Table 4 Method conditions for injecting a test sample

Flow:	15.0 µl/minute
Stoptime:	~7.00 minutes
Solvent A:	30% (HPLC grade Water)
Solvent B:	70% (HPLC grade Acetonitrile)
Wavelength DAD/MWD:	Sample: 254/4 nm, Reference: 360/80 nm
Injector Volume:	200 nl
Column Temperature	25.0 °C or ambient
Agilent 1100 Series Capillary LC Instrument	Degasser Capillary pump - 20 µl/minute sensor installed Micro Autosampler Column Compartment - optional Detector - DAD with 500 nL flow cell installed ChemStation
Column:	ZORBAX SB C18, 5 µm, 150 x 0.5 mm Agilent Part No. 5064-8256
Standard:	Agilent Part No. 01080-68704 0.15 wt.% dimethylphthalate, 0.15 wt.% diethylphthalate 0.01 wt.% biphenyl, 0.03 wt.% o-terphenyl in methanol Diluted 1:10 in Acetonitrile

For system configurations other than those shown above, the method conditions might need to be altered to produce the desired chromatogram.

Procedure

1 Make a single injection of the isocratic test standard under the conditions given Table 4 on page 26.

2 Compare the resulting chromatogram with the typical chromatogram shown in Figure 1.

Typical Chromatogram

A typical chromatogram for this analysis is shown in Figure 1. The exact profile of the chromatogram will depend on the chromatographic conditions. Variations in solvent quality, column packing, standard concentration and column temperature will all have a potential effect on peak retention and response.

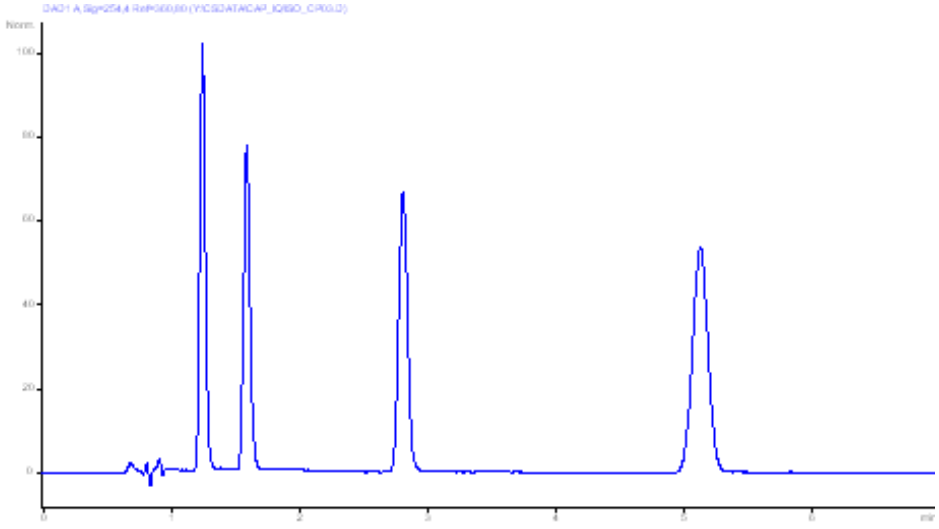

Figure 1 Typical chromatogram for check-out sample

2
Optimizing Performance

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This chapter shows how to optimize your capillary LC system to achieve best chromatographic results:

Hints for Successful Use of the Capillary Pump

Pump issues

- Flush the pump extensively. First with in the **purge mode**, second with a pressure applied to remove all the gas bubbles. It is recommended to do this first with 100% A and than 100%B.
- The system pressure must be higher than 20 Bar at the pump outlet.
- In **micro mode** abnormally high column flow variations are an indication of dirt within the system, blocked filters or loose pump valves.
- Place solvent cabinet with the solvent bottles always on top (or at a higher level) of the capillary pump.
- Prevent blocking of solvent inlet filters (never use the pump without solvent inlet filter). Growth of algae should be avoided.
- When using buffer solutions, flush the system with water before switching it off.
- Check the pump plungers for scratches when changing the piston seals. Scratched plungers will lead to micro leaks and will decrease the lifetime of the seal.
- After changing the plunger seals, perform the seal wear-in procedure. See the pump reference manual.
- Place the aqueous solvent on channel A and the organic solvent on channel B. The default compressibility and flow sensor calibration settings are set so. Always use the correct calibration values.
- For generation of fast gradients on short columns remove the mixer, enter the new pump configuration and select the fast gradient range for the primary flow rate (chromatographic performance will not be affected).
- When running the **micro mode** check the correct instrument setup (flow sensor type, used mixer and filter).
- Make sure to observe the minimum recommended flow setpoint:
  - Normal mode100 µl/min
  - Micro mode, 20 µl flow sensor: 1 µl/min
  - Micro mode, 100 µl flow sensor:10 µl/min

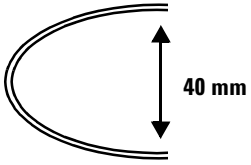
- To achieve the best flow stability, especially in the **micro mode**, %Ripple must be within acceptable values, typically no worse than 2%.

Fused Silica Capillary issues

- When you connect a capillary (especially at the column) press it smoothly into the fitting to avoid air gaps. Incorrect setting will result in dispersion causing tailing or footing peaks.

NOTE Do not overtighten the fused silica capillaries. see Chapter 3, "Capillaries and Fittings," starting on page 45 for information on installing and handling capillaries.

- Be careful when you bend a Fused Silica Capillary. The diameter must not be smaller than 40 mm.



- When you replace a part, especially a capillary, clean it with Acetone.
- If a fused silica capillary leaks, do not retighten under flow. Set column flow to zero, reinsert the capillary, tighten and set new column flow.
- Avoid the use of alkaline solutions (pH > 8.5) which can attack the fused silica from the capillaries.
- Be careful not to crush capillaries when applying module doors.
- A broken capillary can release silica particles into the system (e.g. cell) causing problems in the system down-stream of the break.
- A blocked capillary can often be unblocked by back-flushing the capillary. Acetone is a recommended solvent for capillary back-flushing.

Sampler issues

- For fast gradient use **valve to bypass** function after the sample is transferred to the column. This function results in smaller delay times and sharper gradient curves.
- When doing automated gradient runs, use the **fast composition change/reconditioning** function to equilibrate the system between runs.

Column thermostat issues

- Use the column brackets to put the column in contact with the heat exchanger.
- Do not use the solvent pre-heating path (heat exchanger in the column compartment) when you are working with capillary columns. The dispersion will be too high.

DAD issues

- At very low flow rates, bubbles might form in the cell due to low pressure in the cell. This might cause the detector signal to have spikes and noise. Adding a 50 µm capillary to the outlet of the cell can reduce this effect.
- To avoid cell damage due to overpressure, set the upper pressure limit to 50 bar greater than the typical operating pressure.

Solvent Information

Always filter solvents through 0.4 µm filters, small particles can permanently block the capillaries and valves. Avoid the use of the following steel-corrosive solvents:

- Solutions of alkali halides and their respective acids (for example, lithium iodide, potassium chloride, and so on).
- High concentrations of inorganic acids like sulfuric and nitric acid, especially at higher temperatures (replace, if your chromatography method allows, by phosphoric acid or phosphate buffer which are less corrosive against stainless steel).
- Halogenated solvents or mixtures which form radicals and/or acids, for example:
- $2CHCl_3 + O_2 \rightarrow 2COCl_2 + 2HCl$
- This reaction, in which stainless steel probably acts as a catalyst, occurs quickly with dried chloroform if the drying process removes the stabilizing alcohol.
- Chromatographic grade ethers, which can contain peroxides (for example, THF, dioxane, di-isopropylether) such ethers should be filtered through dry aluminium oxide which adsorbs the peroxides.
- Solvents containing strong complexing agents (e.g. EDTA).
- Mixtures of carbon tetrachloride with 2-propanol or THF dissolve stainless steel.
- Avoid the use of alkaline solutions (pH > 8.5) which can attack the fused silica from the capillaries.

Prevent Blocking of Solvent Inlet Filters

Contaminated solvents or algae growth in the solvent bottle will reduce the lifetime of the solvent filter and will influence the performance of the capillary pump. This is especially true for aqueous solvents or phosphate buffers (pH 4 to 7). The following suggestions will prolong lifetime of the solvent filter and will maintain the performance of the capillary pump.

- Use sterile, if possible amber, solvent bottles to slow down algae growth.
- Filter solvents through filters or membranes that remove algae.
- Exchange solvents every two days or refilter.
- If the application permits add 0.0001 to 0.001 Molar sodium acid to the solvent.
- Place a layer of argon on top of your solvent.
- Avoid exposure of the solvent bottles to direct sunlight.

Checking the solvent inlet filters

WARNING **When opening capillary or tube fittings solvents may leak out. Please observe appropriate safety procedures (for example, goggles, safety gloves and protective clothing) as described in the material handling and safety data sheet supplied by the solvent vendor, especially when toxic or hazardous solvents are used.**

The solvent filters are located on the low-pressure side of the capillary pump. A blocked filter therefore does not affect the pressure readings of the capillary pump. The pressure readings cannot be used to check whether the filter is blocked or not. If the solvent cabinet is placed on top of the capillary pump, the filter condition can be checked in the following way:

Remove the solvent inlet tube from the inlet port of the solvent selection valve or the adapter at the active inlet valve. If the filter is in good condition the solvent will freely drip out of the solvent tube (due to hydrostatic pressure). If the solvent filter is partly blocked only very little solvent will drip out of the solvent tube.

Cleaning the Solvent Filters

- Remove the blocked solvent filter from the bottle-head assembly and place it in a beaker with concentrated nitric acid (65%) for one hour.
- Thoroughly flush the filter with bidistilled water (remove all nitric acid, some columns can be damaged by nitric acid).
- Replace the filter.

CAUTION Never use the system without solvent filters. This could cause damage to the pump valves

Hints for the Micro Vacuum Degasser

If you are using the vacuum degasser for the first time, if the vacuum degasser was switched off for any length of time (for example, overnight), or if the vacuum degasser lines are empty, you should prime the vacuum degasser before running an analysis.

The vacuum degasser can be primed by pumping solvent with the capillary pump at high flow rate (2.5 ml/min). Priming the degasser is recommended, when:

- vacuum degasser is used for the first time, or vacuum chambers are empty.
- changing to solvent that are immiscible with the solvent currently in the vacuum chambers.
- capillary pump was turned OFF for a length of time (for example during night) and volatile solvent mixtures are used.

For more information see the Reference Manual for the Agilent 1100 series micro vacuum degasser.

When to use Alternative Seals

The standard seals for the capillary pump can be used for most applications. However that use normal phase solvents (for example hexane) are not suitable for the standard seals and require a different seal when used for a longer time in the capillary pump. In this case we recommend the use of polypropylene seals, part number 0905-1420 (pack of 2). These seals have less abrasion compared to the standard seals.

CAUTION Polyethylene seals have a limited pressure range 0-200 bar. When used above 200 bar their lifetime will be significantly reduced. **DO NOT** apply the seal wear in procedures performed with the standard seals at 400 bar.

How to Choose the Primary Flow

Primary Flow is a parameter which exists only when the capillary pump is used in the Micro mode. Primary flow is defined as the flow volume and composition available at the inlet to the EMPV. Using this available primary flow, the EMPV and flow sensor work together to deliver and control the requested column flow. All primary flow in excess of the column flow is delivered to waste via the 1/8 inch plastic waste tube connected to the EMPV barbed waste fitting.

In every case, the pump automatically selects the best primary flow for the requested column flow. This ensures optimum column flow stability under all conditions. Primary flow selection is dependent on the current system pressure, and on the existing pump configuration Therefore, it is important that the pump configuration for filter volume and mixer volume is correct.

NOTE Primary flow always is much higher than column flow. This must be considered when calculating the amount of solvent needed for unattended operation.

The user cannot request a specific primary flow value. However, one of three available primary flow ranges can be selected by the user:

Default range (500-800 µl/min)

The default range is the best compromise between performance and solvent savings.

Low Solvent Consumption range (200-500 µl/min)

Certain very long, shallow gradient analyses are possible in the low solvent consumption range, but this range is best suited to isocratic analyses. Selecting this range will result in minimum solvent consumption, but might also result in poorer column flow performance.

Fast Gradients range (800-1300 µl/min)

In this range, the pump gradient delay time is as short as possible. This range is specifically recommended for fast-gradient analyses (<3 min.). Solvent consumption is highest in this range.

Table 5 gives approximate primary flow values (in µl/min) as a function of selected primary flow range vs. system pressure:

Table 5 Primary flow overview for standard pump configuration

	0 bar System pressure	100 bar System pressure	200 bar System pressure	300 bar System pressure	400 bar System pressure
Low consumption range	200	225	250	275	300
Default range	500	570	640	710	780
Fast gradient range	800	995	1190	385	1580

Actual primary flow values may vary from system to system. In any case the standard configuration is changed, the primary flow could be higher compared to the values in above table.

Static Mixer and Filter

The capillary pump is equipped with a static mixer and an inline filter in front of the EMPV.

The standard static mixer

The standard static mixer has a volume of typically 420 µl. To reduce the delay volume of the capillary pump you can remove the mixer.

Conditions to remove the static mixer:

- The delay volume of the capillary pump should be reduced to a minimum for fastest gradient response.
- The detector is used at medium or low sensitivity.

NOTE Removing the mixer will result in an increase of the composition wander and higher detector noise.

The standard filter

The standard filter has a volume of typically 100 µl. If the application needs a reduced volume (e.g. for fast gradient) the 20 µl low volume filter (01090-68703) is recommended. Be aware that the filter efficiency and capacity is significantly reduced compared to the standard one.

NOTE Never run the capillary pump without an inline filter.

How to Optimize the Compressibility Compensation Setting

The compressibility compensation default settings are 50×10^{-6} /bar (best for most aqueous solutions) for pump head A and 115×10^{-6} /bar (to suit organic solvents) for pump head B. The settings represent average values for aqueous solvents (A side) and organic solvents (B side). Therefore it is always recommended to use the aqueous solvent on the A side of the pump and the organic solvent on the B side. Under normal conditions the default settings reduce the pressure pulsation to values (below 1 % of system pressure) that will be sufficient for most applications. If the compressibility values for the solvents used differ from the default settings, it is recommended to change the compressibility values accordingly. Compressibility settings can be optimized by using the values for various solvents described in Table 6 on page 42. If the solvent in use is not listed in the compressibility table, when using premixed solvents and if the default settings are not sufficient for your application the following procedure can be used to optimize the compressibility settings:

NOTE Use the capillary pump in the **Normal Mode** at least 100 µl/min.

1. Start channel A of the capillary pump with the adequate flow rate. The system pressure must be between 50 and 250 bar
2. Before starting the optimization procedure, the flow must be stable. Use degassed solvent only. Check the tightness of the system with the pressure test.
3. Your capillary pump must be connected to an Agilent ChemStation or an Agilent 1100 control module, the pressure and%-ripple can be monitored with one of these instruments,
   otherwise connect a signal cable between the pressure output of the capillary pump and a recording device (for example, 339X integrator) and set parameters.

   Zero 50 %
   Att 2^3
   Chart Speed 10 cm/min
4. Start the recording device with the plot mode.

5 Starting with a compressibility setting of 10×10^{-6} /bar increase the value in steps of 10. Re-zero the integrator as required. The compressibility compensation setting that generates the smallest pressure ripple is the optimum value for your solvent composition.

6 Repeat step 1 through step 5 for the B channel of your capillary pump.

Optimize your compressibility settings by using the values for various solvents listed in the following table:

Table 6 Solvent Compressibility

Solvent (pure)	Compressibility (10^{-6}/bar)
Acetone	126
Acetonitrile	115
Benzene	95
Carbon tetrachloride	110
Chloroform	100
Cyclohexane	118
Ethanol	114
Ethyl acetate	104
Heptane	120
Hexane	150
Isobutanol	100
Isopropanol	100
Methanol	120
1-Propanol	100
Toluene	87
THF	95
Water	46

The Fast Composition Change/Reconditioning Function

Purpose

The capillary pump and the micro well-plate sampler are recommended for capillary LC applications. Capillary LC methods have very low column flow rates, typically in the range of 1-20 µl/min. At such low flow rates, re-equilibrating the system to the initial mobile phase composition between automated gradient runs may require a long time. To conveniently re-equilibrate the system between automated gradient runs, the **Fast Composition Change/Reconditioning** function is implemented.

The **Fast Composition Change/Reconditioning** function is available only in a system that includes both a capillary pump and a micro well-plate sampler. This function can be set up to occur automatically between runs, and/or to occur automatically after any manual composition change.

NOTE The **Fast Composition Change/Reconditioning** function is available only when the capillary pump is operated in the **micro mode**.

How the Function Works

Regardless of when it occurs, the **Fast Composition Change/ Reconditioning** function is always a 2-step process:

1 The micro well-plate sampler needle is placed over the waste position of the flushport. The pump delivers a high flow rate at the initial composition defined in the current method. This flow is maintained for the **Fast System Flush** time defined in the user interface. During this time, the system is being re-equilibrated, up to the sampler needle outlet.

NOTE The high flow rate used for **Fast System Flush** is not user-defined. For the **Fast System Flush**, the pump automatically sets a predetermined maximum pressure limit. This pressure limit is determined by the hardware configuration of the pump.

The flow rate used for **Fast System Flush** is the highest flow which can be delivered without exceeding the pressure limit.

2 When the **Fast System Flush** time has elapsed, the micro well-plate sampler needle is returned to the needle-seat. The pump returns to the normal operating mode, reconditioning the column at the flow and initial composition defined in the current method. The column is reconditioned for the **Column Reconditioning** time defined in the user interface.

If multiple injections are in progress, the next injection will begin when **Fast Composition Change/Reconditioning** is completed.

3
Capillaries and Fittings

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Capillary Flow Diagram

The flow diagram in Figure 2 gives an overview of the capillaries and according fittings used in the capillary LC System.

The capillaries are specified in Table 7 at the right:

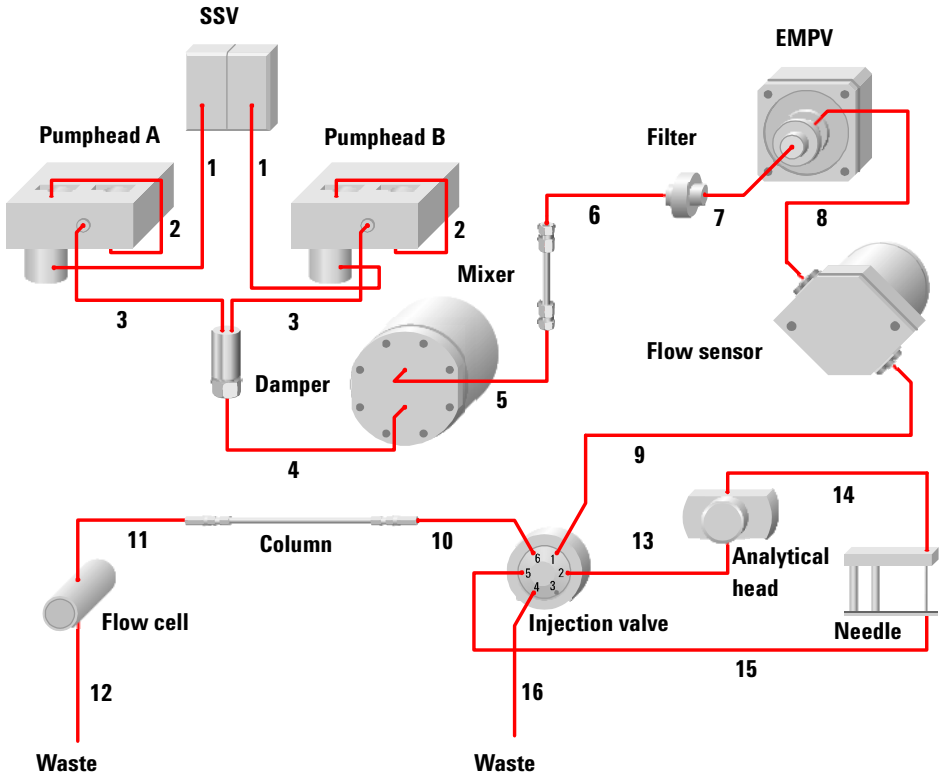


Figure 2 Capillary flow diagram of the Agilent 1100 system capillary LC system

Connecting capillaries for the capillary LC system

Table 7 Generic capillaries for use with a capillary LC system

Item	Fitting type*	Diameter (µm)	Length (mm)	Material	Volume (µl)	Pressure drop (Bar)	Part number
1	A/A			SST†			G1311-67304
2	A/A			SST			G1312-67300
3	A/A			SST			G1312-67302
4	A/A			SST			G1312-67304
5	A/A	250	130	SST	6.4	0	01090-87308
6	A/A	250	130	SST	6.4	0	01090-87308
7	A/A	170	280	SST	6.4	0	G1375-87400
12	E/-	75	700	PFS**	3	2	G1315-68708
14 (micro ALS)	B/B	100	1100	PFS	8.8	<1	G1375-87303
14 (micro ALS)	B/B	250	1800	SST	88	<1	G1329-87302
14 (micro-WPS)	B/D	100	1100	PFS	8.8	<1	G1375-87315
14 (micro-WPS)	B/B	250	1800	SST	88	<1	G1377-87300
15 (micro ALS)	-/C	100	150	PFS	1.2	<1	G1329-87101
15 (micro-WPS)	B/C	100	150	PFS	1.2	<1	G1375-87317
15 (micro-WPS)	B/C	50	150	PFS	0.3	<1	G1375-87300
16	C/-	250	120	SST	<1	0	G1377-87301

* see Table 14 on page 52

† SST: stainless steel

* * PFS: Peek coated fused silica

Refer to Table 8, Table 9 on page 48, Table 10, Table 11 on page 50, or Table 12 on page 50 for specific capillaries.

Table 8 Specific capillaries for use with a 20 µl flow sensor

Item	Fitting type	Diameter (µm)	Length (mm)	Material	Volume (µl)	Pressure drop (Bar)	Part number
8	B/B	50	220	PFS*	1	2	G1375-87301
9	B/C	50	550	PFS	1	6	G1375-87310
10	C/D	50	500	PFS	1	5	G1375-87304
11	D/E	50	400	PFS	1	4	G1315-68703
13 (micro ALS)	C/B	50	200	PFS	1	2	G1375-87302
13 (micro WPS)	C/B	100	200	PFS	<1		G1375-87312

* PFS: Peek coated fused silica

NOTE The pressure drops in Table 7 and Table 8 are calculated for water (viscosity 1) and for a flow rate of 10 µl/min.

Table 9 Specific capillaries for use with a 100 µl flow sensor

Item	Fitting type	Diameter (µm)	Length (mm)	Material	Volume (µl)	Pressure drop (Bar)	Part number
8	B/B	100	220	PFS*	2	<1	G1375-87305
9	C/B	100	550	PFS	4	2	G1375-87306
10	C/D	75	500	PFS	2	5	G1375-87311
11	D/E	75	400	PFS	2	4	G1375-87308
13	B/C	100	200	PFS	2	<1	G1375-87312

*PFS: Peek coated fused silica

NOTE The pressure drops in Table 9 are calculated for water (viscosity 1) and for a flow rate of 50 µl/min.

Table 10 Specific capillaries for use with a flow higher than 200 µl/min

Item descriptions see list below)	Fitting type*	Diameter (µm)	Length (mm)	Material	Volume (µl)	Pressure drop (Bar)	Part number
see description 1 below	A/A	170	280	SST†	6.4	2	G1375-87400
see description 2	B/C	125	550	PFS**	6.8	15	G1375-87318
13	B/C	100	200	PFS	1.6	13	G1375-87312
14 (micro ALS)	B/B	250	1800	SST	88	3	G1329-87302
14 (micro WPS)	B/B	250	1800	SST	88	3	G1377-87300
see description 3	B/C	100	200	PFS	1.6	13	G1375-87312
see description 4	C/B	100	550	PFS	4.4	37	G1375-87306
see description 5	A/A	170	70	SST	1.6	<1	G1316-87300
11	A/A	170	380	SST	8.6	3	G1315-87311

* see Table 14 on page 52

† SST: Stainless steel

* * PFS: Peek coated fused silica

Descriptions to Table 10

1 The capillary G1375-87400 connects the mixer and the manual purge valve.
2 The capillary G1375-87318 connects the manual purge valve and the injection valve (port1).
3 The capillary G1375-87312 connects the injection valve (port 6) and the heat exchanger (IN).
4 The capillary G1375-87306 connects between the injection valve (port 6) and the heat exchanger (IN) if the thermostat G1330A/B is installed.
5 The capillary G1316-87300 connects between the heat exchanger (OUT) and the column.

NOTE The pressure drops in Table 10 are calculated for water (viscosity 1) and for a flow rate of 1000 µl/min.

Table 11 Specific capillaries for use with a micro CSV and a 20 µl flow sensor

From	To	Fitting Type*	Diameter (µm)	Length (mm)	Volume (µl)	Pressure drop (Bar)	Part number
Inj. valve (Port 6)	Micro CSV (Port 4)	C/D	50	280	1	3	G1375-87309
Inj. valve (Port 6)	Micro CSV (Port 4)	C/D	50	500	1	5	G1375-87304
Micro CSV (Port 5)	Column 1 inlet	C/D	50	280	1	3	G1375-87309
Column 1 outlet	Micro CSV (Port 6)	D/C	50	280	1	3	G1375-87309
Micro CSV (Port 1)	Detector	C/D	50	280	1	3	G1375-87309
Micro CSV (Port 3)	Column 2 inlet	C/D	50	280	1	3	G1375-87309
Column 2 outlet	Micro CSV (Port 2)	D/C	50	280	1	3	G1375-87309

Table 12 Specific capillaries for use with a micro CSV and a 100 µl flow sensor

From	To	Fitting Type*	Diameter (µm)	Length (mm)	Volume (µl)	Pressure drop (Bar)	Part number
Inj. valve (Port 6)	Micro CSV (Port 4)	C/D	50	280	1	3	G1375-87309
Inj. valve (Port 6)	Micro CSV (Port 4)	C/D	75	500	2	1	G1375-87311
Micro CSV (Port 5)	Column 1 inlet	C/D	50	280	1	3	G1375-87309
Column 1 outlet	Micro CSV (Port 6)	D/C	50	280	1	3	G1375-87309
Micro CSV (Port 1)	Detector	C/D	50	280	1	3	G1375-87309
Micro CSV (Port 3)	Column 2 inlet	C/D	50	280	1	3	G1375-87309
Column 2 outlet	Micro CSV (Port 2)	D/C	50	280	1	3	G1375-87309

* see Table 14 on page 52

NOTE The pressure drops in Table 11 and Table 12 are calculated for water (viscosity 1) and for a flow rate of 10 µl/min.

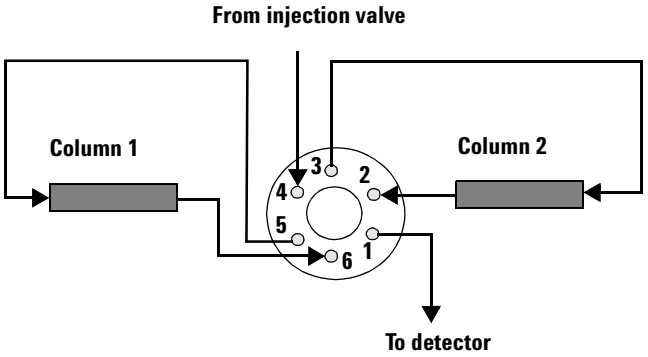


Figure 3 Micro column switching valve connections

Table 13 Additional capillaries

Description	Fitting type	Diameter (µm)	Length (mm)	Material	Volume (µl)	Pressure drop (Bar)	Part number
OQ/PV capillary	C/D	50	400	PFS *	0.8	4.4	G1375-87314
MS capillary	C/2xD	50	1100	PFS *	2.2	12	5065-9906
MS capillary	E/2xD	50	700	PFS *	1.4	7.6	G1375-87313

* PEEK coated fused silica

NOTE The pressure drops in table 13 are calculated for water (viscosity 1) and for a flow rate of 10 µl/min.

NOTE The pressure drops in tables 7 to 13 are indicated values at a specific flow rate and with water (viscosity = 1). For other solvents or other flow rates, use the indicated relation to calculate the approximate pressure drop. Depending on tolerance of the capillary diameter the pressure drop values can vary by +/- 25% compared to the calculated results.

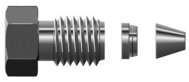
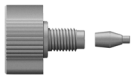
Pressure (Bar) =
Flow(µl/min) x Viscosity (mPa*s) x Length(mm) x 21333 / 3.14 x Diameter4 (µm)

Fittings and Ferrules

Table 14 Fittings and ferrules

Fitting Type	Name	Description	Conditioning	Part Number
A	Swagelock	1/16″ SST fitting, front and back ferrule	10/pk	5062-2418
B	Lite Touch	M4/16″ SST fitting	10/pk	5063-6593
B	Lite Touch	1/32″ SST ferrule and lock ring	10/pk	5065-4423
C	Rheodyne	PEEK fitting	6 fitt/2 plug	5065-4410
D	Finger Tight	Double winged nuts and 1/32″ ferrules	10/pk	5065-4422
E	Lite touch Detector	M4/16″ SST fitting	10/pk	5063-6593
E	Lite touch Detector	SST ferrule	10/pk	5063-6592
E	Lite touch Detector	PEEK sleeve	1/pk	5042-1396

Table 15 Fitting types

Fittings and ferrules	Fitting type
	A
	B
	C
	D

Instructions to connect a capillary.

With Swagelock fitting (type A)

- Slide the nut, the compression ring and the ferrule onto the tubing.
- Insert into the receiving port and finger tighten the fitting into the port.
- Using a 1/4 inch wrench tighten the fitting 3/4 wrench turn.

With Rheodyne fitting (type C).

- Slide the fitting on the capillary.
- Insert into the receiving port, and finger tighten the fitting into the port.
- Using a 1/4 inch wrench tighten the fitting 1/4 wrench turn.

With Lite Touch fitting (type B or E)

NOTE The Lite Touch ferrule System may be used with any stainless steel nut, or corresponding Lite Touch nut.

- Slide the nut, steel compression ring and PEEK ferrules, (in that order), onto the tubing. The flattened end of the ring should face towards the nut with the narrower end of the ferrule toward the ring.
- Insert into the receiving port. Hold the tubing to the bottom of the fitting while tightening down the nut. Tighten comfortably finger-tight.
- Using a 4 mm wrench tighten the stainless steel nut down with a 1/4 wrench turn.

With finger tight fitting (type D).

- Slide fitting and ferrule onto the tubing.
- Insert it into the receiving port and finger tighten the nut until snug.

Hints for Successful use of Capillaries and Fittings

- Never overtighten a fitting.
- Never cut a capillary
- Take care when you bend a capillary (diameter never below 40 mm).
- Avoid the use of alkaline solutions (pH > 8.5) which can attack the fused silica from the capillaries.
- When connecting, press the capillary smoothly into the fitting to avoid air gaps.
- If a capillary leaks, never retighten it under flow.
- A blocked capillary can often be cleaned by flushing it back. Acetone is recommended for this.
- Take care when applying module doors, not to crush capillaries.
- A broken capillary can release silica particles in the system.

4
Basic System Troubleshooting

System Pressure Abnormally Low 56
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In this troubleshooting guide, you will find a Possible Causes/Suggested Actions approach to troubleshooting and correcting certain capillary LC system problems.

The problems are categorized by the symptoms as listed in the content list above.

NOTE This troubleshooting guide deals with systemic problems of the capillary LC. For detailed diagnostic, troubleshooting and repair information on specific LC modules (status indicators, error messages, diagnostic tests, etc.), refer to the Reference Manual supplied with the specific LC module.

System Pressure Abnormally Low

Symptoms:

The current system pressure is significantly below the typical system pressure produced by this method with this column.

System Pressure Abnormally Low: Possible causes and actions

Possible Causes	Suggested Actions	Notes
Leaks somewhere in the system	• Use a flashlight and absorbent tissue to search for leaks throughout the system.	At very low flow rates, a leak may never accumulate enough liquid to trigger the module leak sensors. Low flow rate leaks are also very hard to see.
Solvent channels are not correctly purged. %Ripple might also be too high	• Perform a 2-minute purge at 2500 µl/min for each solvent channel.	This is especially likely if the system has been unused for more than one day.
Dirty solvent inlet filters Solvent intake is being restricted, %Ripple might also be too high	• Temporarily remove solvent inlet filters to see if they are the cause of the problem. If so, clean or replace the solvent inlet filters.	To minimize this problem, prefilter the mobile phase, and take precautions against algae formation in the water.

System Pressure Abnormally High

Symptoms:

The current system pressure is significantly above the typical system pressure produced by this method with this column.

System Pressure Abnormally High: Possible causes and actions

Possible Causes	Suggested Actions	Notes
The analytical column has become plugged	• Replace the column. Otherwise, backflush the column or replace the column inlet frit.	
The filter in front (upstream) of the EMPV has become plugged	• Perform a pump purge at 1000 µl/min using pure water. During the purge, check system pressure. If pressure is >10 bar, replace the EMPV filter.	If a new filter does not reduce the pressure, replace the mixer.
A component in the micro-sampler has become plugged. This could be the sample loop, needle, needle seat assembly or injection valve ports.	• Using the sampler maintenance positions, switch the sampler injection valve from mainpass to bypass. If pressure is significantly reduced: **a** Backflush or change the needle seat assembly. **b** Replace the needle. **c** Backflush or replace the sample loop capillary. **d** Replace the injection valve rotor seal. **e** Clean the stator head with acetone, and make sure the stator head ports are free of particles.	For severe capillary tube plugs, acetone is a good backflushing solvent.
A pre-sampler, or post-sampler capillary in the system has become plugged, broken, crushed by a module cover or overtightened.	• Refer to the system flow diagram. One at a time, disconnect the capillaries in the following order. When the defective capillary is found, it may be backflushed with acetone, or replaced. **a** EMPV-to-flow sensor capillary **b** flow sensor-to-sampler injection valve capillary **c** sampler injection valve-to-column inlet capillary **d** flow cell assembly (includes inlet and outlet capillaries)	

EMPV failed to initialize (micro mode only)

Symptoms:

An attempt to pump in the micro mode has resulted in either an EMPV Initialization Failed error message, or a permanent EMPV Initialization not ready message.

EMPV failed to initialize: Possible Causes and Suggested Actions

Possible Causes	Suggested Actions	Notes
The no-flow pressure of the system is higher than 10 bar.	• Set the flow to zero, and disconnect the blue flexible capillary going from the damper to the mixer The system pressure reading should be close to zero bar. • If the system pressure reading is higher than 4 bar, call Agilent service, or refer to the Capillary Pump Reference Manual.	This problem typically causes a permanent EMPV Initialization not ready message.
The inlet to the EMPV has been blocked, or partially restricted. The EMPV cannot take in sufficient flow to deliver the correct flow output. The EMPV initialization routine cannot be done within the required 2-minute period.	• Make sure the solvent channels are well purged. • Check the EMPV filter. Perform a pump purge at 1000 µl/min using pure water. During the purge, check system pressure. If pressure is >10 bar, replace the EMPV filter. If a new filter does not reduce the pressure, replace the mixer. • Check the flow path from the damper outlet to the EMPV inlet for plugs or restrictions. • Check the EMPV-to-flow sensor capillary for a total plug or partial restriction. Replace the capillary, or backflush the capillary with acetone. • Replace the EMPV assembly (G1361-60000). Call Agilent service or refer to the Capillary Pump Reference Manual.	This problem typically causes an EMPV Initialization Failed error message

Unstable column flow and/or system pressure

Symptoms:

In the micro mode, the pump flow control system is active. The flow control system continuously measures the actual value of column flow, and maintains the requested column flow despite changes in system restriction. If the flow control becomes defective, actual column flow, hence system pressure, will fluctuate. If the system offers a changing restriction to the pump, actual column flow will fluctuate as the pump tries to maintain flow against the changing restriction. Therefore, in the micro mode, unstable column flow and unstable system pressure usually appear together.

Unstable column flow and/or system pressure: Possible Causes and Suggested Actions

Possible Causes	Suggested Actions	Notes
The flow setpoint is below the recommended minimum value.	• Make sure that the column flow setpoint is above the recommended minimum setpoint:	Normal mode 100 µl/min Micro mode, 20 µl flow sensor 1 µl/min Micro mode, 100 µl flow sensor 10 µl/min
The system pressure is insufficient for reliable flow control (micro mode).	• Make sure that there is at least 20 bar pressure being developed after the pump. • Add an additional capillary after the pump if required.	
Leaks somewhere in the system.	• Use a flashlight and absorbent tissue to search for leaks throughout the system. Check for leaks after the pump, and inside the pump (valves, fittings, etc.) • If operating in the micro mode, perform the micro mode leak test. If operating in the normal mode, perform the normal mode pressure test.	At very low flow rates, a leak may never accumulate enough liquid to trigger the module leak sensors. Low flow rate leaks are also very hard to see. Refer to the Capillary Pump Reference Manual for information on these tests.
One or more solvent channels are not correctly purged. %Ripple might also be too high.	• Perform a 2-minute purge at 2500 µl/min for each solvent channel.	This is especially likely if the system has been unused for more than one day.

Unstable column flow and/or system pressure: Possible Causes and Suggested Actions (continued)

Possible Causes	Suggested Actions	Notes
Dirty solvent inlet filters. Solvent intake is being restricted. %Ripple might also be too high.	• Temporarily remove solvent inlet filters to see if they are the cause of the problem. If so, clean or replace the solvent inlet filters.	To minimize this problem, prefilter the mobile phase, and take precautions against algae formation in the water.
Dirty EMPV (micro mode only)	• Perform the EMPV cleaning procedure, followed by the EMPV performance test. Refer to the Capillary Pump Reference Manual.	
Any system component which is offering a changing restriction to the pump.	• Replace the analytical column. • Replace the filter frit in front (upstream) of the EMPV.	
The vacuum micro-degasser is off, or has become defective.	• Try another vacuum micro-degasser, or experiment to determine the performance using different degasser channels. • If the mobile phase is very sensitive to gaseousness, use the micro-degasser continuous mode.	
Basic performance problems in the pump.	• Perform the pump Leak Test.	Refer to the Capillary Pump Reference Manual for information on the leak test.

Poor peak shape

Symptoms:

The peak shape has taken on a fronting or tailing characteristic.

Poor peak shape: Possible Causes and Suggested Actions

Possible Causes	Suggested Actions	Notes
Column performance has deteriorated	• Try a new column	
Poorly made capillary connections, causing excessive dead volume or leaks in a chromatographically significant area of the system	• Using a flashlight and absorbent tissue, carefully check for leaks throughout the system, especially in the following areas: **a** All micro-sampler valve ports. **b** Column inlet and outlet. **c** Flow cell inlet capillary, at the capillary/cell body junction. • Refer to chapter 3 for information on connecting capillaries. Make sure the capillary connections are correctly made throughout the system, especially in the following areas: **a** All micro-sampler valve ports. **b** Column inlet and outlet. **c** Flow cell inlet capillary, at the capillary/cell body junction.	At very low flow rates, a leak may never accumulate enough liquid to trigger the module leak sensors. Low flow rate leaks are also very hard to see.
Capillaries which are internally broken, especially those capillaries located in a chromatographically significant area.	• Refer to chapter 3 for advice on diagnosing an internally broken capillary. Check capillaries for an internal break, particularly the needle-seat capillary, the sampler valve-to-column capillary and the flow cell inlet capillary.	Capillaries which have been crushed by module covers are often broken internally, and may show no external evidence of a break.

Failure to produce peaks, or abnormally small peaks, after injection

Symptoms:

There are no peaks, or the peak size is significantly below the typical peak size for this method with this column.

Failure to produce peaks, or abnormally small peaks, after injection: Possible Causes and Suggested Actions

Possible Causes	Suggested Actions	Notes
A leak in a sample carrying area of the system.	• Using a flashlight and absorbent tissue, carefully check for leaks in the following areas: a. All micro-sampler valve ports. b. The junction of the needle and sample loop capillary. c. The needle/seat interface. d. Column inlet and outlet. e. Flow cell inlet capillary, at the capillary/cell body junction.	At very low flow rates, a leak may never accumulate enough liquid to trigger the module leak sensors. Low flow rate leaks are also very hard to see.
The 40 µl chamber of the micro-sampler metering head has developed bubbles.	• In the user interface diagnostics, access the **Change Piston** function of the micro-sampler maintenance positions. This function draws the metering piston fully inward, clearing the chamber. • Under flow conditions, activate this function for at least 5 minutes. The sampler valve must be in the mainpass position at this time. Any bubbles which have formed in the chamber will now be cleared by the flow.	In most applications, only a small part of the available 40µl metering head volume is used. At very low flows, bubbles may form in the unused space between the metering piston and the chamber wall. The bubbles act to defeat the draw of sample into the needle. For best results in clearing bubbles, the mobile phase being pumped should not contain water.

Wandering Detector Baseline

Critical Decision Determine if the problem is in the DAD, or coming from the LC system:

Remove the flow cell from the DAD. Close the cell cover, and see if the baseline performance improves.

1 If baseline performance has not improved:

   a Replace the lamp(s).

   b Evaluate the environment for excessive drafts, temperature changes, etc.

2 If baseline performance has improved, focus attention on the possible causes and suggested actions below.

Wandering Detector Baseline Possible Causes and Suggested Actions

Possible Causes	Suggested Actions	Notes
Dirty or defective flow cell	• Clean or replace the flow cell	
The analytical column	• Bypass the column. Pump directly into the flow cell. If performance improves, try a new column.	
Running with the pump mixer removed	• Reinstall the mixer, and evaluate the performance of the baseline. If the baseline performance improves, a solution must be found which is a compromise between mixing volume and other chromatographic requirements.	The mixer may have been removed in an attempt to reduce gradient delay volume.
"Mixing Noise" when pumping a binary mobile phase from two channels.	• Try premixing the mobile phase in one bottle, and pumping 100% from that one solvent channel. If baseline performance improves, a solution must be found which is a compromise between mixing volume and other chromatographic requirements. For an isocratic analysis, premixing and pumping 100% one channel is the best solution.	This problem occurs when one (or both) of the solvents has a high background absorbance at the detection wavelength. In this case, the pump's mixing efficiency may not be good enough to produce a sufficiently homogeneous mobile phase. The detector reacts to gluts of the more detectable parts of the solvent mixture, and baseline disturbances result.

Wandering Detector Baseline Possible Causes and Suggested Actions (continued)

Possible Causes	Suggested Actions	Notes
Unstable flow and/or system pressure.	• Refer to the problem Unstable flow and/or system pressure above. If your system suffers from this problem, go through the possible causes and suggested actions described there.	Failure to maintain stable column flow or system pressure can also cause unwanted baseline activity.

User interface displays error messages for specific modules

User interface displays error messages for specific modules: Possible causes and suggested actions

Possible Causes	Suggested Actions	Notes
A module has experienced a specific hardware failure during operation	• Refer to the Reference Manual supplied with the module. Follow the advice on troubleshooting and repair for the error message displayed.	A specific error message for that module is displayed. The status indicator of that module is red.

5
Parts and Materials

Micro Vacuum Degasser 66,
Capillary Pump 69,
Micro Well-plate Sampler 77,
Thermostatted Micro Autosampler 86
Thermostatted Column Compartment 95,
Diode Array Detector 101,
Common Parts 110
Cables 121

This chapter shows detailed illustrations and lists for the parts identification for the complete system. It is divided into module specific parts sections and a common parts section.

Micro Vacuum Degasser

Table 16 gives an overview over the main assemblies:

Table 16 Micro vacuum degasser main assemblies

Item	Description	Part Number
1	Vacuum degasser control assembly	G1322-66500
2	Board clip	G1322-43100
3	Solenoid valve	G1322-60003
4	Vacuum tube set	G1379-67300
5	Fixing plate	no PN
6	Vacuum pump	G1322-60000
7	Leak tray	G1379-27300
8	Leak pan, degasser	G1379-47300
9	Vacuum chamber	G1379-60001
10	Sensor assembly (included in the control assembly)	no PN
11	Fuse 500 mA	2110-0458

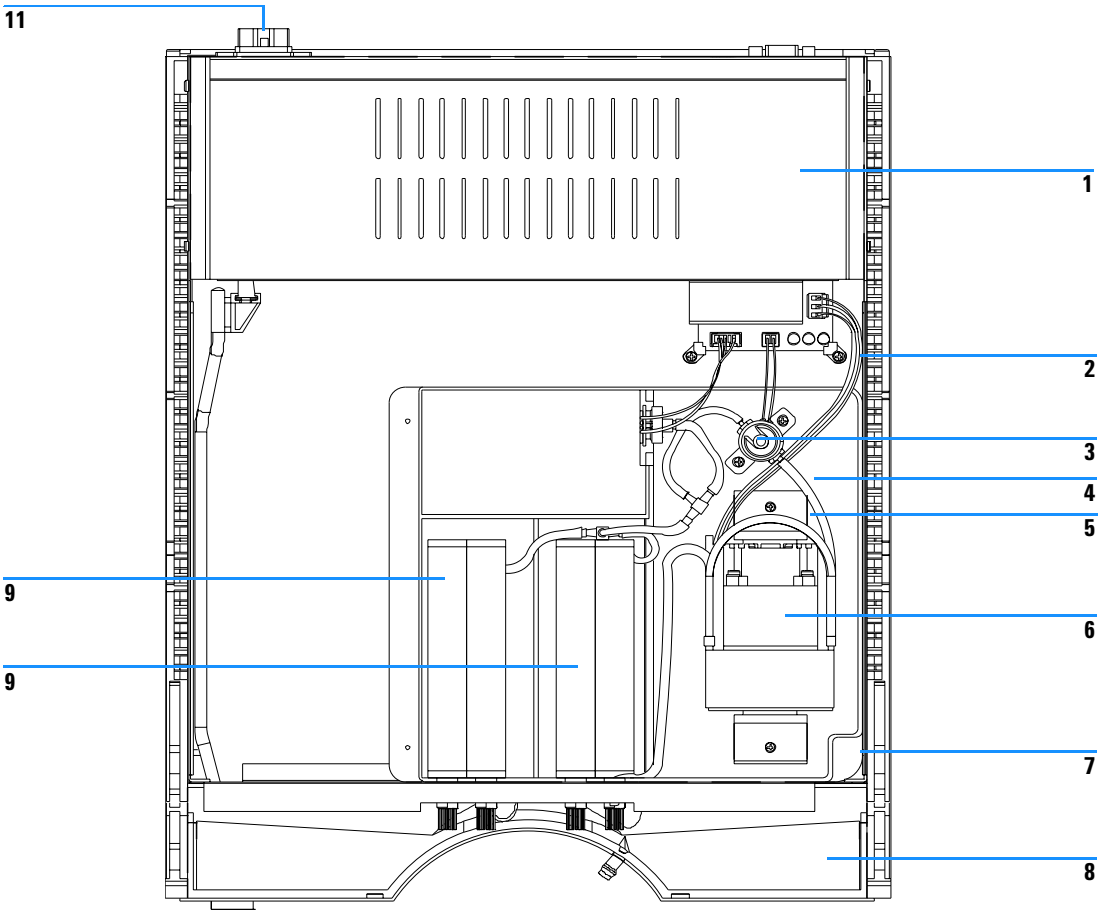


Figure 4 Micro vacuum degasser main assemblies

Micro Vacuum Degasser Cover Parts

Table 17 Micro vacuum degasser cover parts

Item	Description	Part Number
1	Cabinet kit, includes base, side panels, top and front cover	5062-8579
2	Tube clip	5041-8387
3	Logo plate, Agilent 1100	5042-1381
4	Front cover	5062-8580

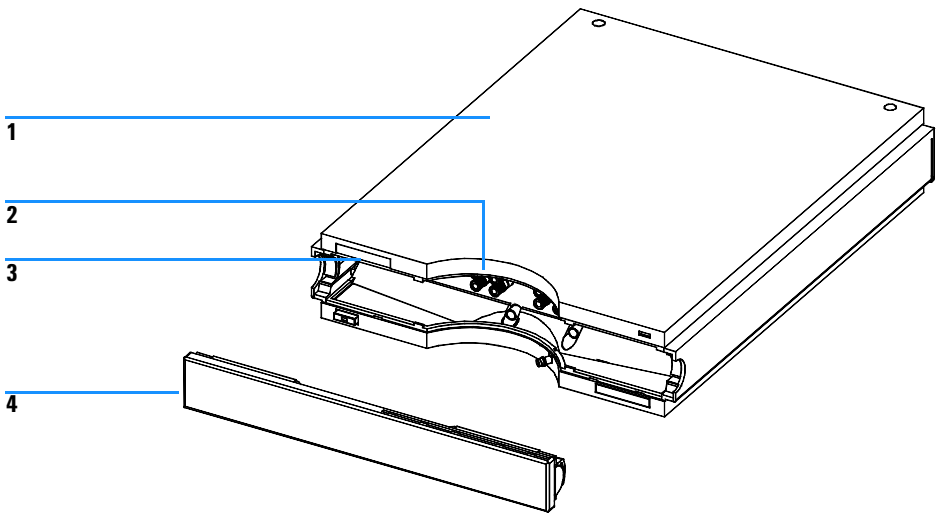


Figure 5 Micro vacuum degasser cover parts

Capillary Pump

Table 18 gives an overview over the main assemblies of the capillary pump. The item numbers refer to Figure 6:

Table 18 Capillary pump main assembly

Item	Description	Part Number
1	Capillary system main board (CSM) Exchange CSM board	G1376-66530 G1376-69530
2	Power supply	0950-2528
3	Solvent selection valve connecting cable	G1312-61602
4	Flow sensor 20 µl Flow sensor 100 µl	G1376-60001 G1376-60002
5	Leak pan - pump	5041-8390
6	Solvent selection valve (half of a complete valve)	G1312-60000
	Solvent selection valve screw	5022-2112
7	Pump drive assembly Exchange pump drive assembly	G1311-60001 G1311-69001
8	Pump head, see page 74	G1311-60004
9	EMPV holding screw (pack of 2)	0515-0850
10	EMPV valve body	G1361-60009
11	EMPV complete assembly (valve and solenoid)	G1361-60000
12	AIV connecting cable	G1311-61601
13	Damping unit	79835-60005
14	Fan assembly	3160-1017

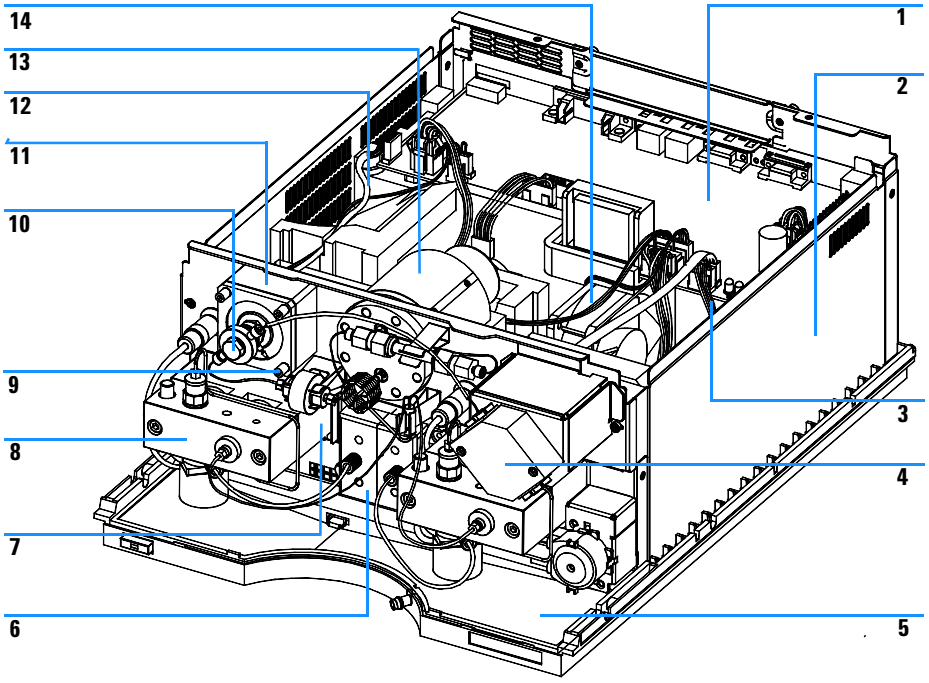


Figure 6 Capillary pump main assembly

Solvent Cabinet and Bottle Head Assembly

Table 19 Solvent cabinet and bottle-head assembly

Item	Description	Part Number
	Solvent cabinet, complete assembly	5062-8581
1	Solvent tubing 5 m	5062-2483
2	Tube screw (pack of 10)	5063-6599
3	Ferrules with lock ring (pack of 10)	5063-6598
4	Bottle amber Bottle transparent	9301-1450 9301-1420
5	Solvent inlet filter (SST)	01018-60025
6	Leak pan, solvent cabinet	5042-1307
7	Front panel, solvent cabinet	5062-8580
8	Name plate, Agilent 1100	5042-1381
	Bottle-head assembly for Capillary pump includes items 1, 2, 3, 5	G1311-60003

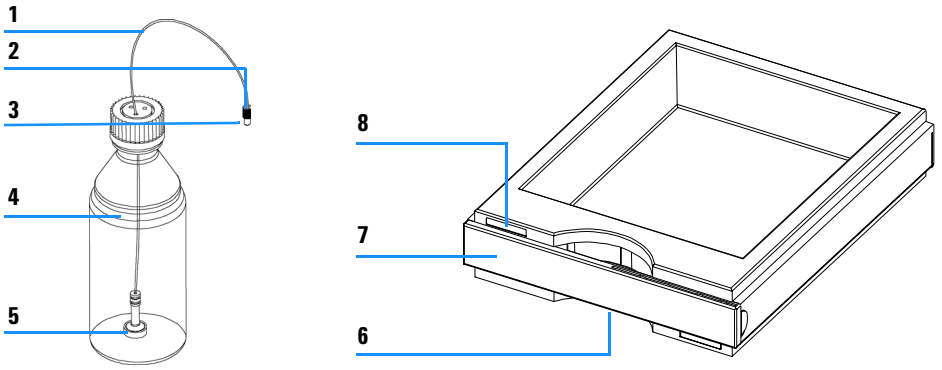


Figure 7 Solvent cabinet and bottle head assembly

Capillary Pump Hydraulic Path

Table 20 Capillary pump hydraulic path

Item	Description	Part Number
1	Mixer	G1312-87330
2	Damper to mixer capillary	01090-87308
3	EMPV to FS cap (220 mm, 50 µm) *for 20 µl flow sensor* EMPV to FS cap (220 mm, 100 µm) *for 100 µl flow sensor*	G1375-87301 G1375-87305
4	Outlet ball valve to piston 2 capillary	G1312-67300
5	FS to inj valve cap (550 mm, 50 µm) *for 20 µl flow sensor* FS to inj valve cap (550 mm, 100 µm) *for 100 µl flow sensor*	G1375-87310 G1375-87306
6	Restriction capillary	G1312-67304
7	Connection tube	G1311-67304
8	Mixing capillary	G1312-67302
9	Filter assembly (includes frit) Frit	5064-8273 5022-2185
10	Filter to EMPV cap (280 mm, 170 µm)	G1375-87400
11	Solvent tube (pack of 4)	G1322-67300
	Corrugated waste tube, 120 cm (re-order 5 m)	5062-2463

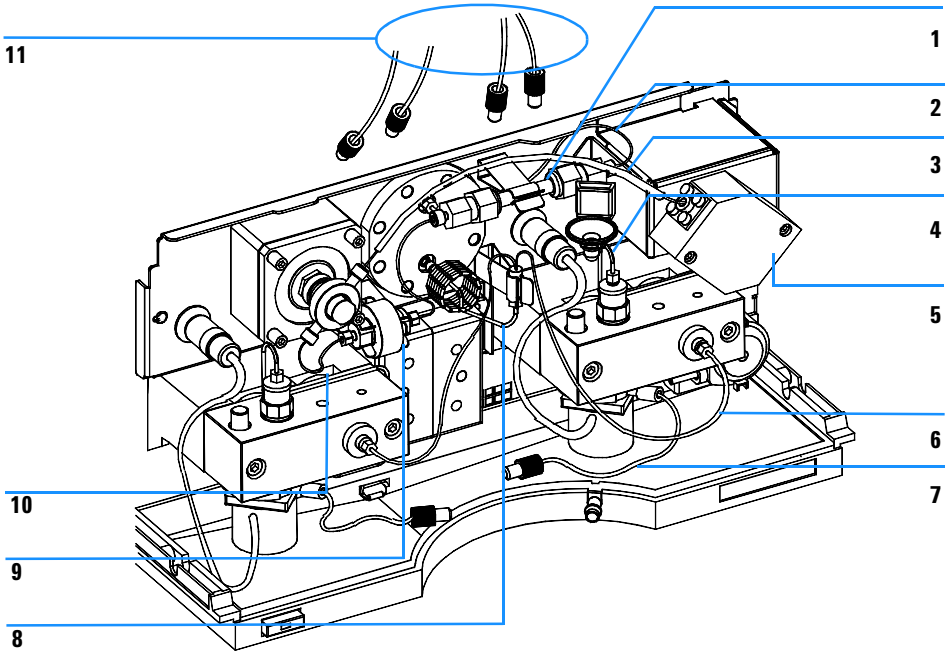


Figure 8 Capillary pump hydraulic path

Pump-Head Assembly

Table 21 Pump-head assembly

Item	Description	Part Number
Pump head assembly, includes items marked with (*)		G1311-60004
1*	Outlet ball valve	G1312-60012
2*	Screw lock	5042-1303
3*	Screw M5, 60 mm	0515-2118
4*	Apdater	G1312-23201
5	Pump chamber housing	G1311-25200
6*	Active inlet valve (complete with cartridge) Replacement cartridge for active inlet valve	G1312-60010 5062-8562
7	Seal (pack of 2) or Seal (pack of 2), for normal phase applications	5063-6589 0905-1420
8	Plunger housing (including springs)	G1311-60002
9*	Sapphire plunger	5063-6586
10	Support ring	5001-3739
11*	Outlet valve to piston 2 capillary	G1312-67300

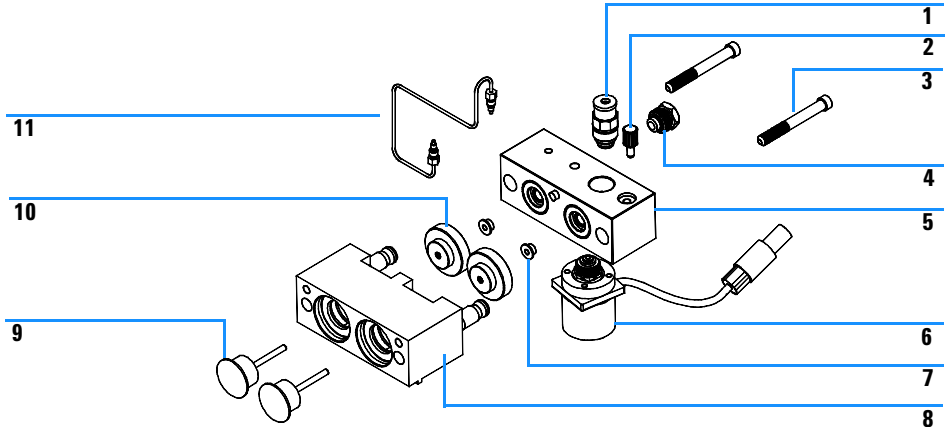


Figure 9 Pump head assembly

Capillary pump cover parts

Table 22 gives an overview over the cover parts of the capillary pump. The item numbers refer to Figure 10:

Table 22 Capillary pump cover parts

Item	Description	Part Number
1	Plastic cover kit (includes top, base and both sides)	G1312-68703
2	Front plate	G1312-60011
3	Logo plate, Agilent 1100	5042-1381

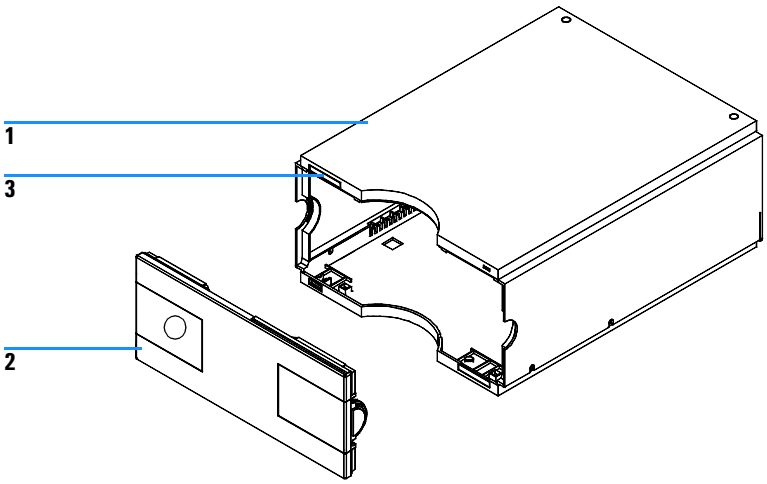


Figure 10 Capillary pump cover parts

Micro Well-plate Sampler

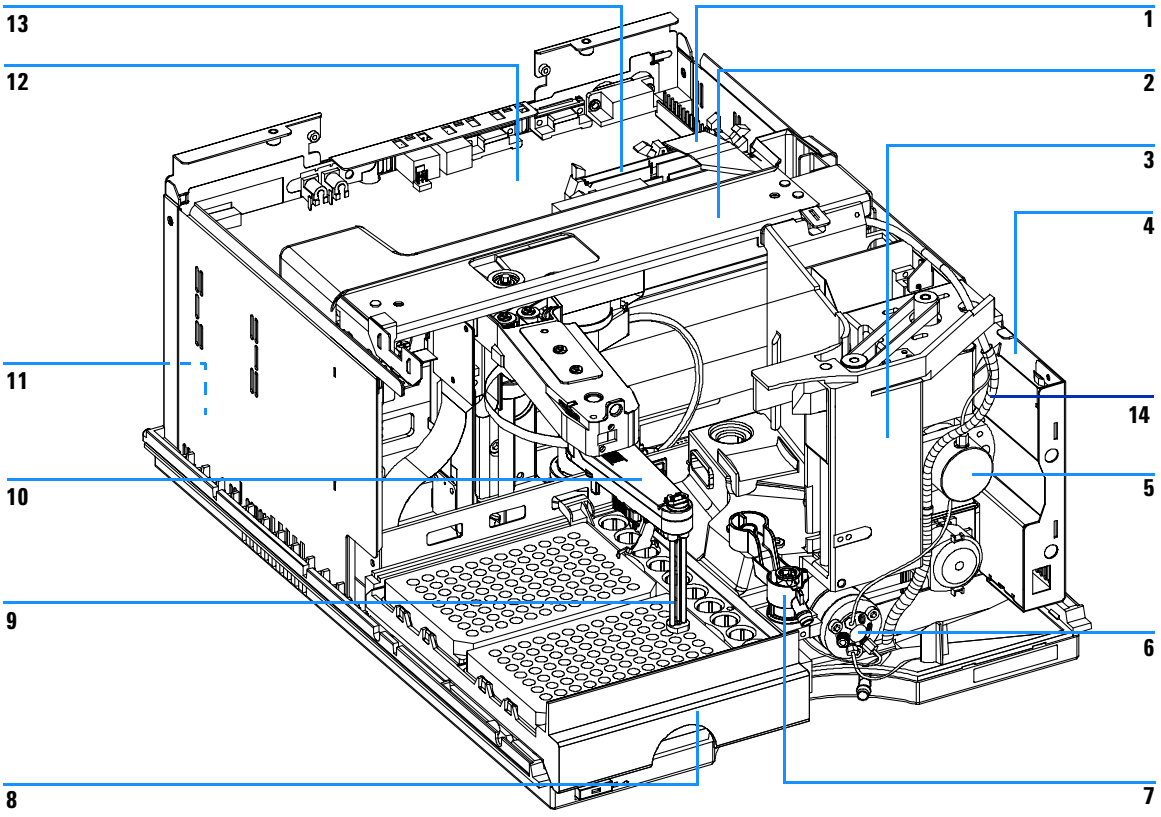


Figure 11 Micro well-plate sampler main assemblies

Table 23 Micro well-plate sampler main assemblies

Item	Description	Part Number
1	Ribbon Cable (from SU to MTP)	G1313-81602
2	Sample Transport assembly *for G1377A*	G1377-60009
3	Sampling Unit assembly *for G1377/78A* (The assembly comes without injection valve and analytical head)	G1377-60008
4	SLS board (not shown)	G1367-66505
5	Analytical Head assembly (40 µl) *for G1377/78A*	G1377-60013
6	Micro Injection valve assembly *for G1377/78A*	0101-1050
7	Needle Seat assembly *for G1377/78A (without capillary)* Seat cap. (0.10 mm ID 1.2 µl) *for G1377-87101 Needle Seat* Seat cap. (0.05 mm ID 0.3 µl) *for G1377-87101 Needle Seat*	G1377-87101 G1375-87317 G1375-87300
8	Plate Tray	G1367-60001
9	Needle assembly *for G1377/78A*	G1377-87201
10	Needle Carrier assembly	G1367-60010
11	Power supply assembly (not visible)	0950-2528
12	Well-plate Sampler Main Board (MTP) Exchange Assembly - MTP board	G1367-66500 G1367-69500
13	Ribbon Cable (from ST to MTP)	G1364-81601
14	Loop capillary waste tube	G1367-60007
	WPS leak kit	G1367-60006
	Ribbon Cable (from SLS to MTP) (not visible)	G1367-81600
	Sampler-TCC cap. (500 mm, 0.05 mm id) *for G1377/78A*	G1375-87304
	Fan (not visible)	3160-1017
	Fan exhaust (not visible)	3160-4097
	BCD board (not visible)	G1351-68701

Sampling Unit for the Micro Well-plate Sampler

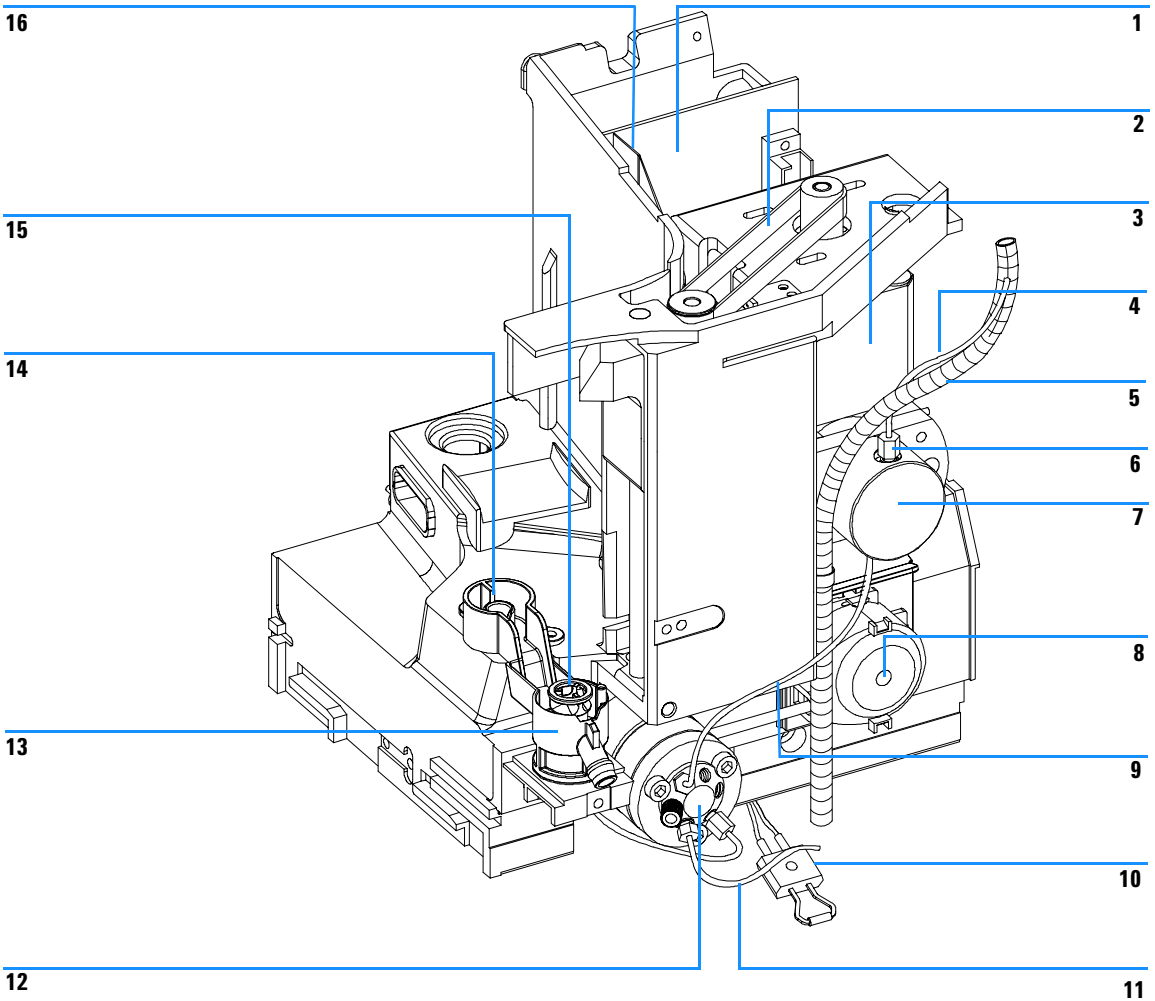


Figure 12 Sampling unit for the micro well-plate sampler

Table 24 Sampling unit for the micro well-plate sampler

Item	Description	Part Number
Sampling Unit assembly *for G1377/78A* (The assembly comes without injection valve and analytical head)		G1377-60008
1	Sampling unit connector board (SUD)	G1313-66503
2	Belt gear *for metering unit and needle arm*	1500-0697
3	Stepper motor *for metering unit and needle arm*	5062-8590
4	Loop capillary, 40 µl *for G1377/78A* Loop capillary, 8 µl *for G1377/78A*	G1377-87300 G1375-87315
5	Loop capillary waste tube	G1367-60007
6	Seal tight nut *for G1377-87300 capillary*	0100-2086
7	Analytical Head assembly 40 µl *for G1377/78A*	G1377-60013
8	Peristaltic pump, includes tubing	5065-4445
9	Inj-Valve-Anal Head cap (200 mm 0.10 mm ID) *for G1377/78A*	G1375-87312
10	Leak sensor	5061-3356
11	Waste tube *for G1377/78A*	G1377-87301
12	Micro Injection Valve assembly *for G1377/78A*	0101-1050
13	Seat adapter	G1367-43200
14	Flush port	G1367-47700
15	Needle Seat (without capillary) *for G1377/78A* Seat capillary (150 mm 0.10 mm ID) *for G1377-87101 Needle Seat* Seat capillary (150 mm 0.05 mm ID) *for G1377-87101 Needle Seat*	G1377-87101 G1375-87317 G1375-87300
16	Flex board	G1313-68715
	Air barrier (not visible)	G1367-44105
	Stepper motor peristaltic pump (not visible)	5065-4409
	Motor holder (not visible)	G1367-42304
	Plate peristaltic pump (not visible)	G1367-44100

Micro Analytical Head Assembly

Table 25 Micro analytical head assembly

Item	Description	Part Number
Micro Analytical head assembly 40 µl, includes items 1 – 6		G1377-60013
1	Screws	0515-0850
2	Micro Plunger assembly	5064-8293
3	Adapter	01078-23202
4	Micro seal support assembly	G1377-60002
5	Metering seal (pack of 1)	5022-2175
6	Head body	G1377-27700
	Screw M5, 60 mm lg, for mounting of assembly	0515-2118

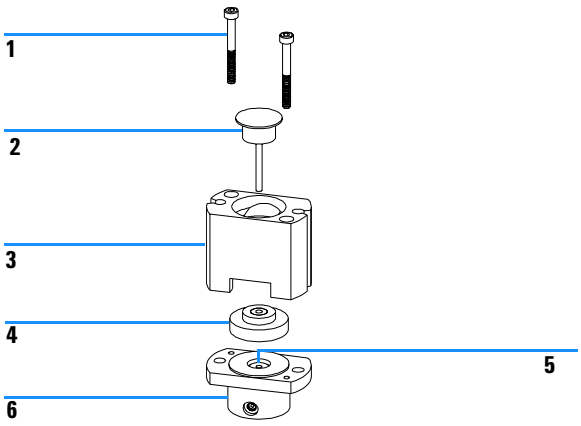


Figure 13 Micro analytical head assembly

Micro Injection Valve Assembly

Table 26 Micro injection valve assembly

Item	Description	Part Number
Micro Inj.-valve assembly, incl. items 1 – 2 – 3 – 5 – 6		0101-1050
2	Isolation seal	0100-1852
3	Micro rotor seal (Vespel)	0100-2088
5	Micro Stator head	0100-2089
6	Stator screws	1535-4857

NOTE The micro injection valve assembly has no ceramic stator face.

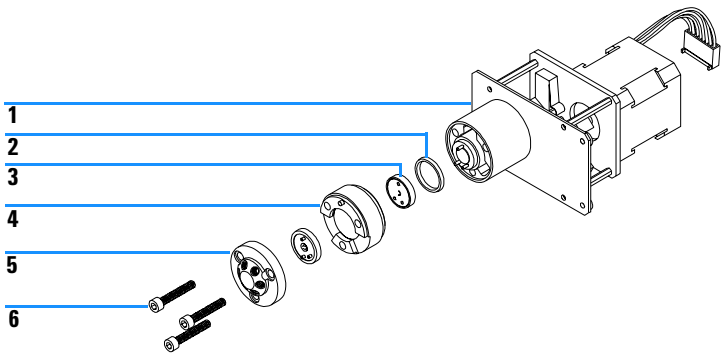


Figure 14 Micro injection valve assembly

Micro Well-plate Sampler - Vial Trays

Table 27 Micro well-plate sampler vial trays and tray base

Item	Description	Part Number
1	Tray for 2 plates + 10 × 2-ml vials	G1367-60001
2	Tray for 100 × 2-ml vials, thermostattable	G1329-60001
3	Tray for 100 × 2-ml vials	G1313-44500
4	Screws for springs	0515-0866
5	Spring	G1313-09101
6	Spring stud	0570-1574
7	Tray base (includes items 4,5,6)	G1329-60000
8	Adapter air channel	G1329-43200
	Plug channel (not shown)	G1367-47200

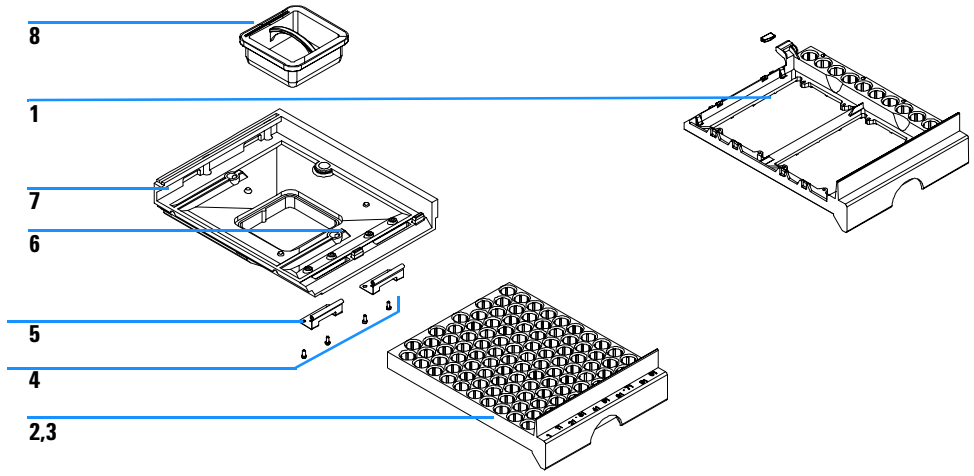


Figure 15 Vial trays and tray base

Table 28 Recommended plates and closing mat

Description	Rows	Columns	Plate height	Volume (µl)	Part Number	Package
384 Agilent	16	24	14.4	80	5042-1388	30
384 Corning	16	24	14.4	80	No Agilent PN	
384 Nunc	16	24	14.4	80	No Agilent PN	
96 Agilent	8	12	14.3	400	5042-1386 5042-1385	10 120
96 CappedAgilent	8	12	47.1	300	5065-4402	1
96 Corning	8	12	14.3	300	No Agilent PN	
96 CorningV	8	12	14.3	300	No Agilent PN	
96 DeepAgilent31mm	8	12	31.5	1000	5042-6454	50
96 DeepNunc31mm	8	12	31.5	1000	No Agilent PN	
96 DeepRitter41mm	8	12	41.2	800	No Agilent PN	
96 Greiner	8	12	14.3	300	No Agilent PN	
96 GreinerV	8	12	14.3	250	No Agilent PN	
96 Nunc	8	12	14.3	400	No Agilent PN	
Closing mat for all 96 Agilent plates	8	12			5042-1389	50

Micro Well-Plate Sampler Cover Parts

Table 29 Micro well-plate sampler cover parts

Item	Description	Part Number
Cabinet kit, includes base, side panels, top and front cover		5065-4446
	Name plate for Agilent 1100 Series	5042-1381
	Light protection kit, includes dark front cover and side window	5064-8272

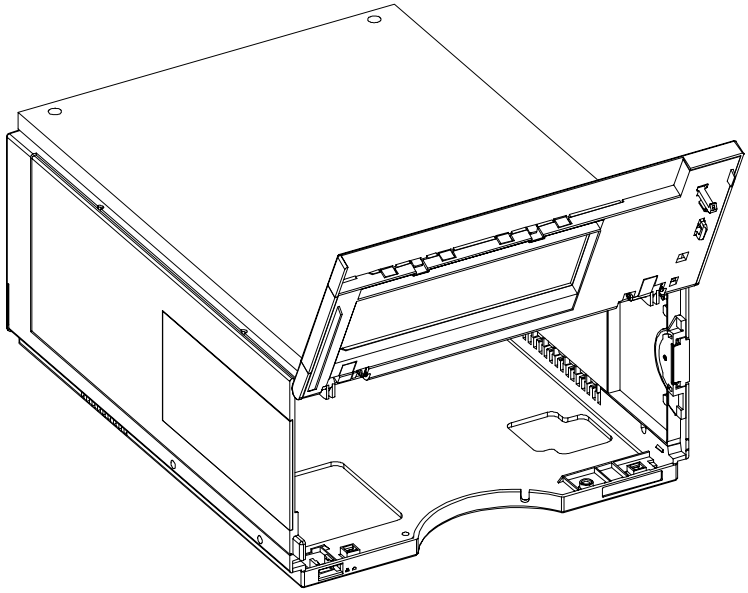


Figure 16 Micro well-plate sampler cover parts

Thermostatted Micro Autosampler

Table 30 offers an overview over the main assemblies of the Thermostatted Micro Autosampler. The item numbers refer to Figure 17 on page 87.

Table 30 Thermostatted micro autosampler main assemblies

Item	Description	Part Number
1	Transport assembly	G1329-60009
2	Micro needle assembly	G1329-80001
3	Sampling unit assembly *for G1389A* (The assembly comes without injection valve and analytical head)	G1329-60018
4	Analytical head assembly (40 µl)	G1377-60013
5	Injection valve assembly	0101-1050
6	Needle-seat assembly (0.10 mm i.d 1.2 µl) Standard Needle-seat assembly (0.05 mm i.d 0.3 µl)	G1329-87101 G1329-87103
7	Vial tray, thermostatted	G1329-60001
8	Gripper assembly	G1313-60010
9	Power supply assembly	0950-2528
10	Autosampler main board (ASM) Exchange Assembly - ASM board	G1329-66500 G1329-69500
11	Ribbon cable sample transport to main board	G1313-81601
12	Ribbon cable, sampling unit to main board	G1313-81602
	Fan	3160-1017
	Sampler - TCC cap (500 mm 50 µm) with a 20 µl FS Sampler - TCC cap (500 mm 75 µm) with a 100 µl FS	G1375-87304 G1375-87311
	BCD board (not shown)	G1351-68701
	Cable, autosampler to ALS thermostat	G1330-81600

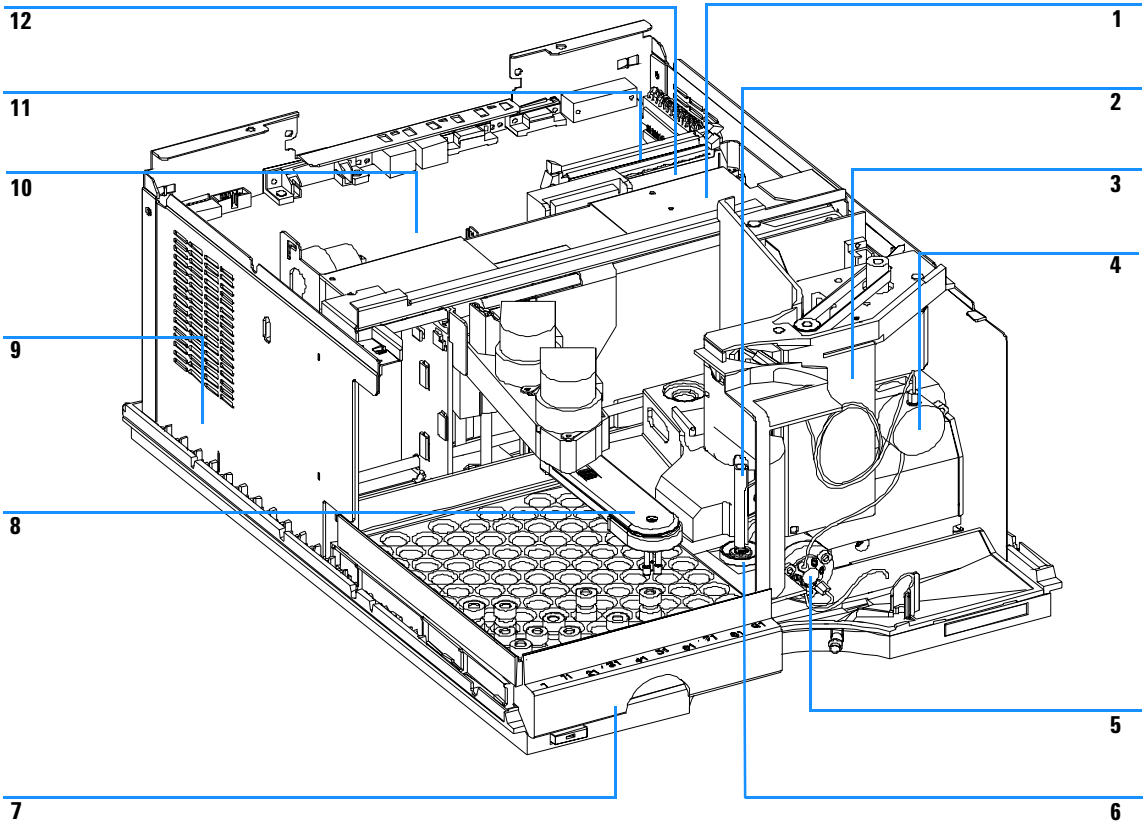


Figure 17 Thermostatted micro autosampler main assemblies

Thermostat for 1100 Samplers

Table 31 Thermostat for micro autosampler and micro well-plate sampler

Description	Part Number
Thermostat for 1100 samplers, exchange assembly	G1330-69020

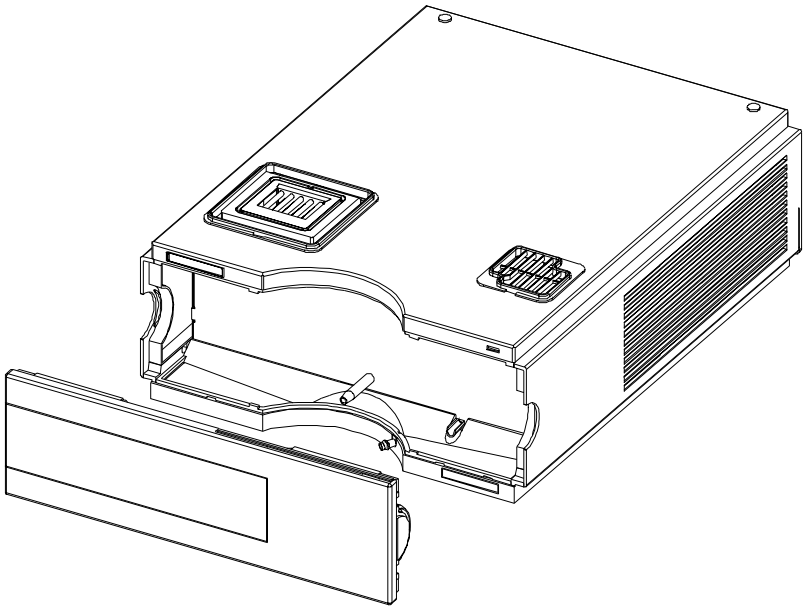


Figure 18 Thermostat

Sampling Unit for the Micro Autosampler

Figure 19 offers an overview over the main assemblies of the Thermostatted Micro Autosampler. For descriptions of the item numbers refer to Table 32.

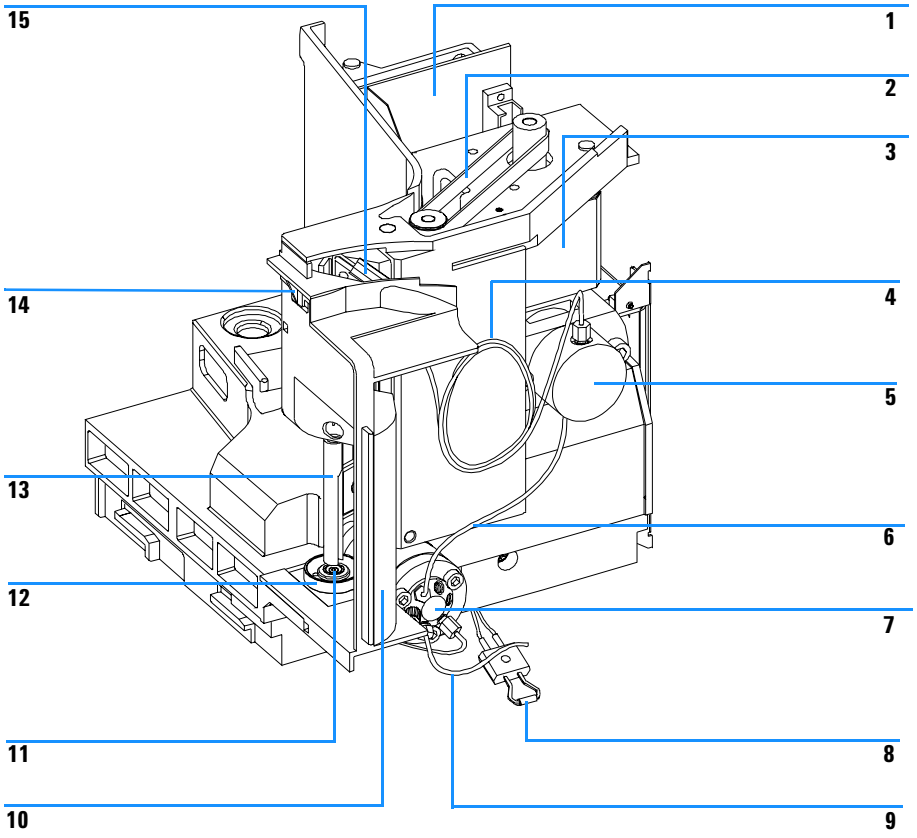


Figure 19 Sampling unit for the micro autosampler

Table 32 Sampling unit for the micro autosampler

Item	Description	Part Number
	Micro sampling unit assembly (The assembly comes without injection valve and analytical head)	G1329-60018
1	Sampling unit connector board (SUD)	G1313-66503
2	Belt gear *for metering unit and needle arm*	1500-0697
3	Stepper motor *for metering unit and needle arm*	5062-8590
4	Loop capillary (8 µl) Loop capillary (40 µl)	G1375-87303 G1329-87302
5	Analytical head assembly (40 µl)	G1377-60013
6	Inj valve - Anal head cap (200 mm 50 µm) with a 20 µl FS Inj valve - Anal head cap (200 mm 100 µm) with a 100 µl FS	G1375-87302 G1375-87312
7	Injection valve assembly	0101-1050
8	Leak sensor	5061-3356
9	Waste tube injection valve assembly (120 mm 250 µm)	G1313-87300
10	Safety cover	G1329-44105
11	Needle-seat assembly (0.10 mm i.d 1.2 µl) Standard Needle-seat assembly (0.05 mm i.d 0.3 µl)	G1329-87101 G1329-87103
12	Seat adapter	G1313-43204
13	Safety flap	G1313-44106
14	Flex board	G1313-68715
15	Micro needle assembly	G1329-80001
	Clamp Kit (includes needle clamp and 2 x clamp screw)	G1313-68713

Micro Analytical Head Assembly

Table 33 Micro analytical head assembly

Item	Description	Part Number
Micro Analytical head assembly 40 µl, includes items 1 – 6		G1377-60013
1	Screws	0515-0850
2	Micro Plunger assembly	5064-8293
3	Adapter	01078-23202
4	Micro seal support assembly	G1377-60002
5	Metering seal (pack of 1)	5022-2175
6	Head body	G1377-27700
	Screw M5, 60 mm lg, for mounting of assembly	0515-2118

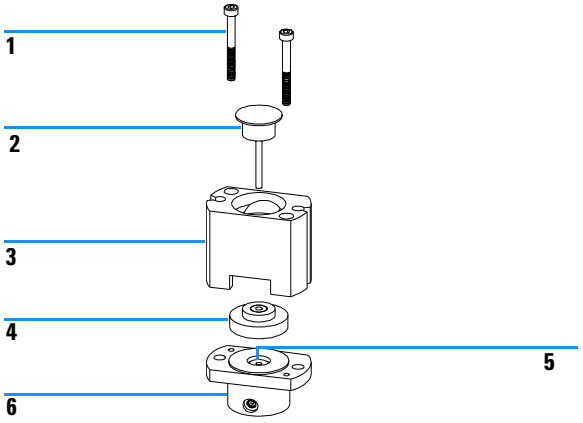


Figure 20 Micro analytical head assembly

Micro Injection Valve Assembly

Table 34 Micro injection valve assembly

Item	Description	Part Number
Micro Inj.-valve assembly, incl. items 1 – 2 – 3 – 5 – 6		0101-1050
2	Isolation seal	0100-1852
3	Micro rotor seal (Vespel)	0100-2088
5	Micro Stator head	0100-2089
6	Stator screws	1535-4857

NOTE The micro injection valve assembly has no ceramic stator face

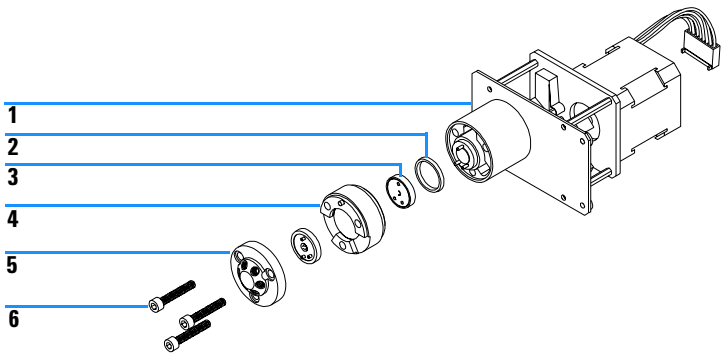


Figure 21 Micro injection valve assembly

Thermostatted Micro Autosampler Cover Parts

Table 35 Thermostatted micro autosampler cover parts

Item	Description	Part Number
1	Autosampler Cover kit (include base, side panels and top cover)	G1329-68703
2	Name plate for Agilent 1100 Series	5042-1381
3	Transparent front cover	G1313-68704
4	Door repair kit (includes transparent side and front door)	G1329-68707
5	Light protection kit (includes opaque side and front door, opaque front cover)	G1329-68708
	Cabinet upgrade kit (includes side panels, top cover, transparent side and front door, front cover and side insulation cover for thermostatted autosampler)	G1329-68706

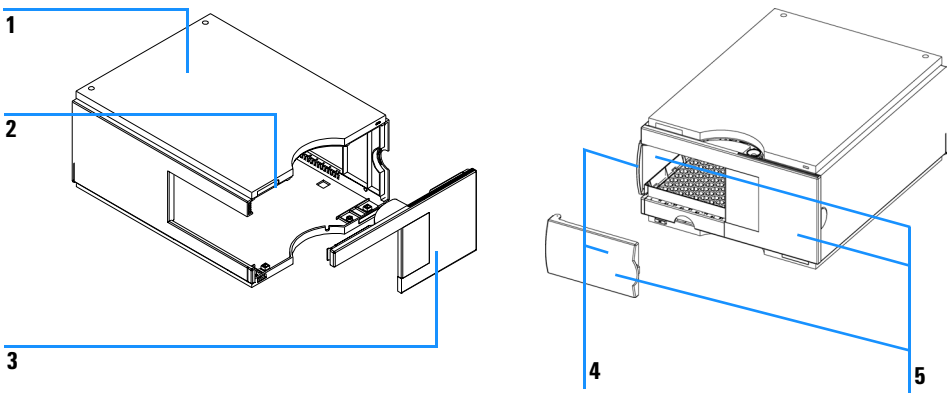


Figure 22 Thermostatted micro autosampler cover parts

Vial Trays

Table 36 Thermostatted autosampler vial trays and tray base

Item	Description	Part Number
1	Tray for 100 × 2-ml vials, thermostattable	G1329-60001
2	Adapter, air channel	G1329-43200
3	Tray base (includes items 4, 5, 6).	G1329-60000
4	Plug, tray base	no PN
5	Spring	G1313-09101
6	Screws for springs	no PN

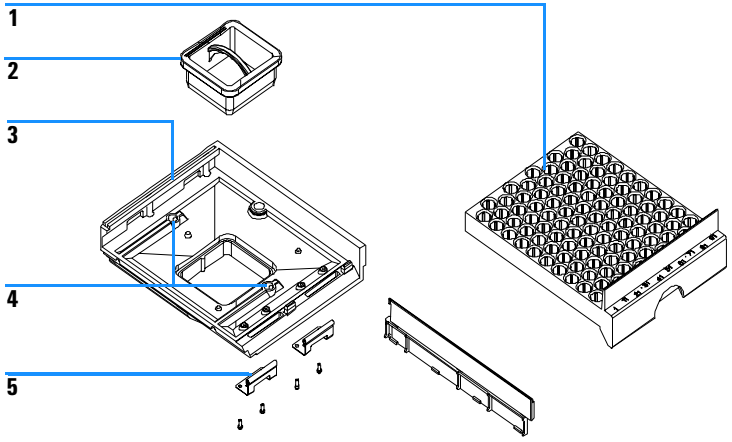


Figure 23 Thermostatted autosampler vial trays and tray base

Thermostatted Column Compartment

Table 37 gives an overview over the main assemblies of the Thermostatted column compartment. The item numbers refer to Figure 24:

Table 37 Thermostatted column compartment main assemblies

Item	Description	Part Number
1	Fan assembly	3160-1017
2	Column identification board CID	G1316-66503
3	Column compartment main board CCM (exchange part)	G1316-69520
4	Power supply assembly	0950-2528
5	Heater (right)	G1316-60006
6	Leak sensor assembly	5061-3356
7	Heater (left)	G1316-60007
8	Leak handling parts	See page 100
9	Column switching valve, additional column switching valve parts, see page 97	0101-1051
	Cable CAN to Agilent 1100 Series modules	5181-1516
	Column identification board CID	G1316-66503
	Low dispersion capillary (0.12 mm i.d., 70 mm)	G1316-87303
	Capillary Kit Column Switching, see page 97	G1316-68708
	Column bracket (long version)	5001-3702

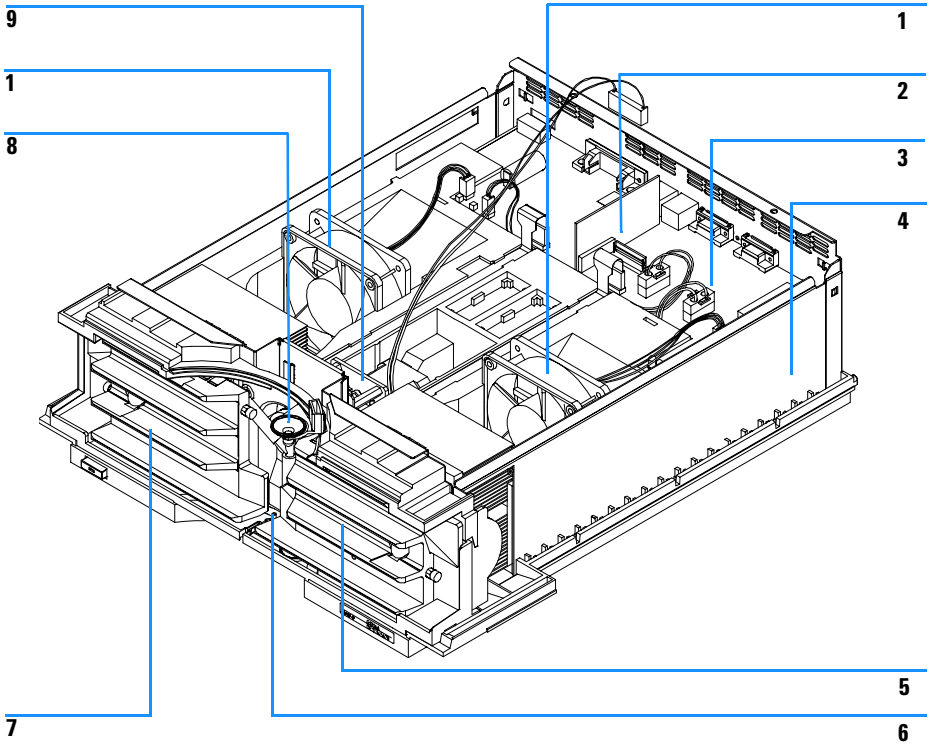


Figure 24 Thermostatted column compartment main assemblies

Micro Column Switching Valve

Table 38 Micro column switching valve

Item	Description	Part Number
Column switching valve (complete assembly)		0101-1051
1	Rotor seal 3 grooves (Vespel)	0100-2087
2	Stator ring	No PN
3	Stator Head	0100-2089
4	Stator screw	1535-4857

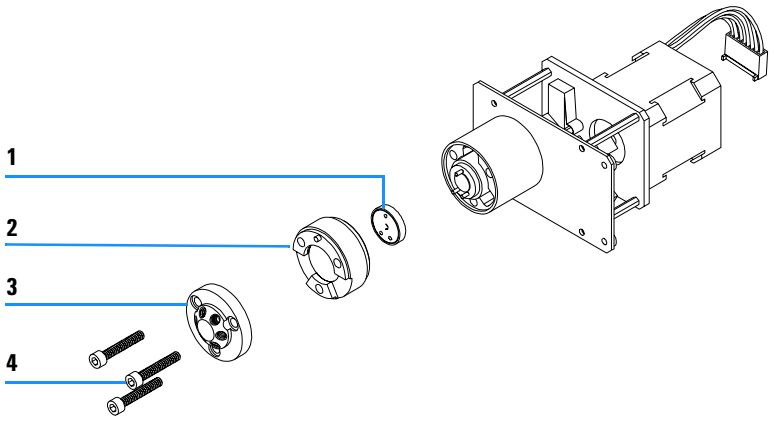


Figure 25 Micro column switching valve

Thermostatted Column Compartment Sheet Metal Kit

Table 39 Thermostatted column compartment sheet metal kit

Item	Description	Part Number
Sheet metal kit includes items 1, 2 and 3		G1316-68701
4	RFI shield	G1316-00600
5	RFI spring side	G1316-09100
6	RFI spring bottom	G1316-09102

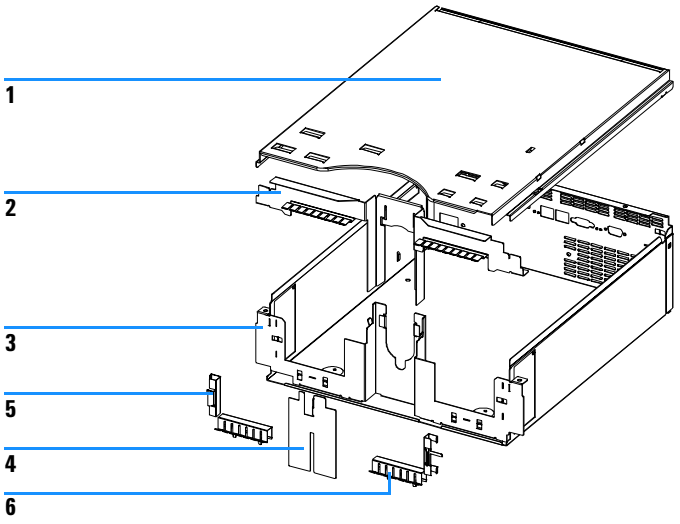


Figure 26 Thermostatted column compartment sheet metal kit

Thermostatted Column Compartment Cover Parts

Table 40 Thermostatted column compartment cover parts

Item	Description	Part Number
1	Plastic kit, includes base, sides and top	G1316-68703
2	Front cover	G1316-68704
3	Name plate Agilent 1100 Series	5042-1381

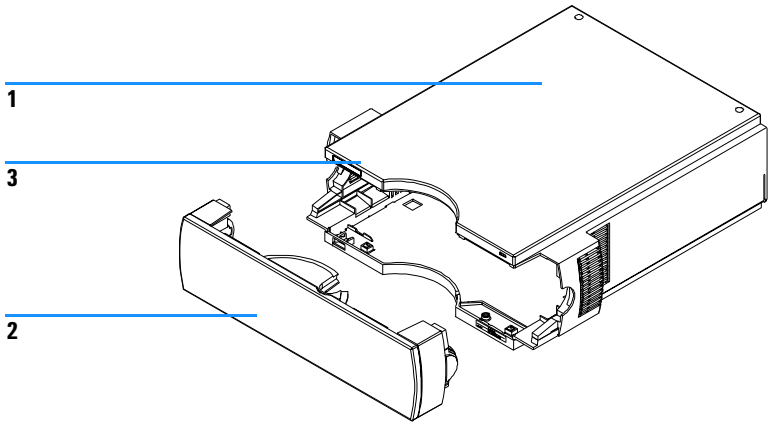


Figure 27 Thermostatted column compartment cover parts

Thermostatted Column Compartment Leak Parts

Table 41 Thermostatted column compartment leak parts

Item	Description	Part Number
1	Leak funnel	5041-8388
2	Leak funnel holder	G1316-42300
3	Leak sensor	5061-3356
4	Waste assembly, includes complete Y-tubing assembly with leak funnel	G1316-60002
5,7	Leak Kit, includes leak top and leak base	G1316-68700
6	O-ring for ambient temperature sensor	0400-0002
	Corrugated waste tube, 120 cm (re-order 5 m)	5062-2463

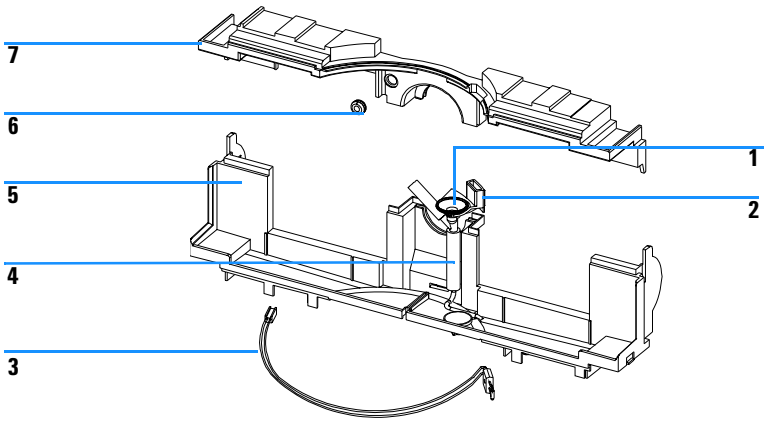


Figure 28 Thermostatted column compartment leak parts

Diode Array Detector

Table 42 gives an overview over the main assemblies of the diode array detector:. The item numbers refer to Figure 29

Table 42 Diode array detector main assemblies

Item	Description	Part Number
1	Interface board BCD (BCD/external contacts)	G1351-68701
2	Main board DAM for G1315B DAD (exchange assembly)	G1315-69530
3	Power supply	0950-2528
4	Leak sensor assembly	5061-3356
5	500 nl flow cell kit	G1315-68714
6	Tungsten lamp	G1103-60001
7	Longlife Deuterium lamp Standard Deuterium lamp	5181-1530 2140-0590
8	Fan assembly, for heater and sensor page 95	3160-1016
9	Optical unit (exchange assembly), for additional optical unit parts, see page 81	G1315-69002
	Fuse for BCD board, 250 mA (total of 4 are on the board)	2110-0004
	Cable CAN to Agilent 1100 Series modules	5181-1516

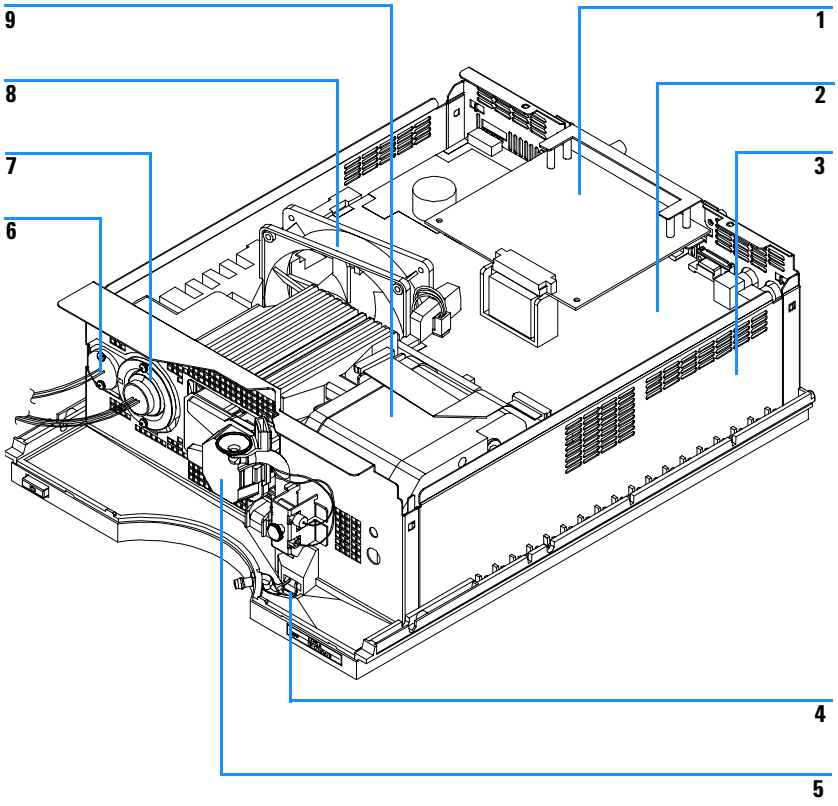


Figure 29 Diode array detector main assemblies

DAD - Optical Unit Assembly

Table 43 gives an overview over optical unit parts:. The item numbers refer to Figure 30

Table 43 Optical Unit Assembly

Item	Description	Part Number
1	Optical unit (exchange assembly)	G1315-69002
2	500 nl flow cell	G1315-68714
3	Longlife Deuterium lamp Standard Deuterium lamp	5181-1530 2140-0590
4	Tungsten lamp	G1103-60001
5	Cable SCI - DAM	G1315-61604
6	Damping kit, includes 6 bumpers	G1315-68706
7	Flow cell door (seal included)	G1315-68707
	Screws M3 for flow cell door (6 ×)	5022-2112
8	Plug hole for lamp housing	6960-0002
9, 10, 11	Holmium oxide filter parts, see page 108	
12	Spring, for other holmium oxide filter parts, see page 108	1460-1510
13	Coupling lens assembly	G1103-68001
14	Source lens (achromate) assembly	G1315-65201
15	Cell support assembly	G1315-65202
16	Sealing	G1315-47103

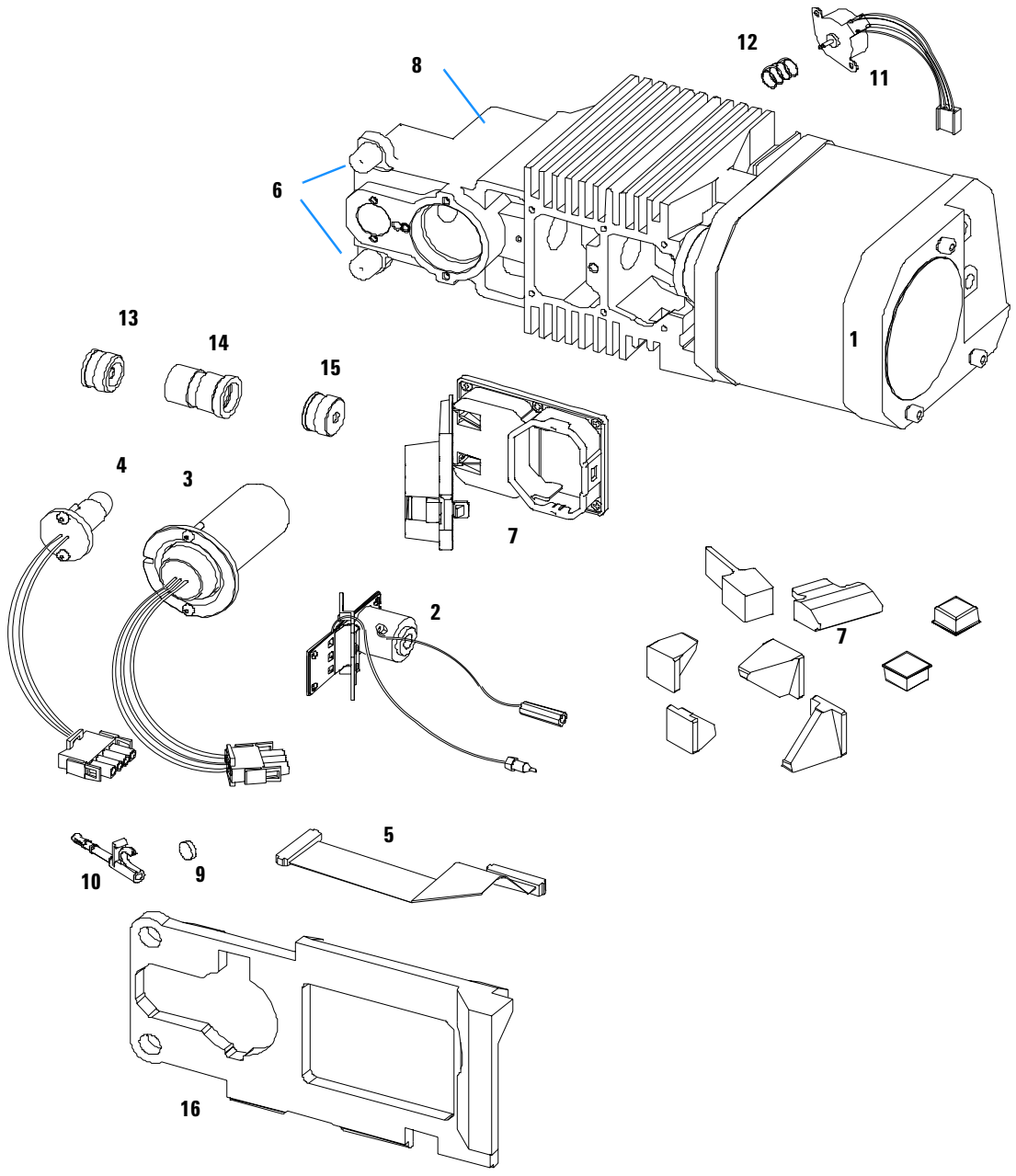


Figure 30 Optical Unit Parts

500 nl Flow Cell

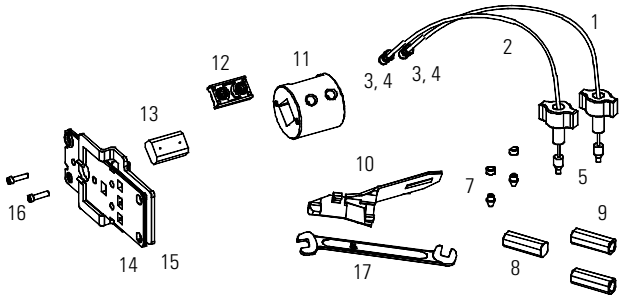


Figure 31 500 nl Flow Cell

Table 44 500 nl Flow Cell - parts

Item	Description	Part Number
500 nl Flow Cell Kit		G1315-68714
	Flow cell assembly, 10 mm, 500 nl, 5 MPa completely assembled includes items 1, 2, 3, 4, 11, 12, 13, 14, 15, and 16	
1	Capillary column to detector (400 mm, 50 µm)	G1315-68703
2	Capillary column to detector (700 mm, 75 µm)	G1315-68708
3	Fitting Screw - for 4 mm wrench, QTT=2 (reorder 10/pk)	5063-6593
4	Cell ferrules are factory installed	
5	PEEK fitting 1/32, not attached to capillaries	5063-6592
7	Upchurch Litetouch ferrules LT-100, (front and back), QTY=4 (reorder 10/pk)	5063-6592
8	Union - Top - Adjustment Tool, used for item #7	5022-2146
9	Union - Top - Seal, QTY=2	5022-2145
10	Torque Adapter	G1315-45003*
11	Cell Housing 10 mm	

Table 44 500 nl Flow Cell (continued)- parts

Item	Description	Part Number
12	Cell Seal Assembly 10 mm	see kit below
13	Quartz Cell Body 10 mm	G1315-80001
14	Handle for clamp unit	G1315-84901
15	Clamp unit	G1315-84902
16	Screw M 2.5, 4 mm lg for cell body/clamp	0515-1056
	Additional kits and parts	
1	Capillary column to detector (400 mm, 50 µm)	G1315-68703
2	Capillary column to detector (700 mm, 75 µm)	G1315-68708
	Sealing Kit, includes items 10, 12 and 7 (QTY=5)	G1315-68715
17	Wrench open end 4 mm	8710-1534†

* part of Sealing Kit

† supplied with standard accessory kit G1315-68705

Fan Assembly Parts

Table 45 Fan assembly parts

Item	Description	Part Number
1	Heater assembly	G1315-60000
2	Fan	3160-1016
3	Temperature sensor assembly	G1315-60003

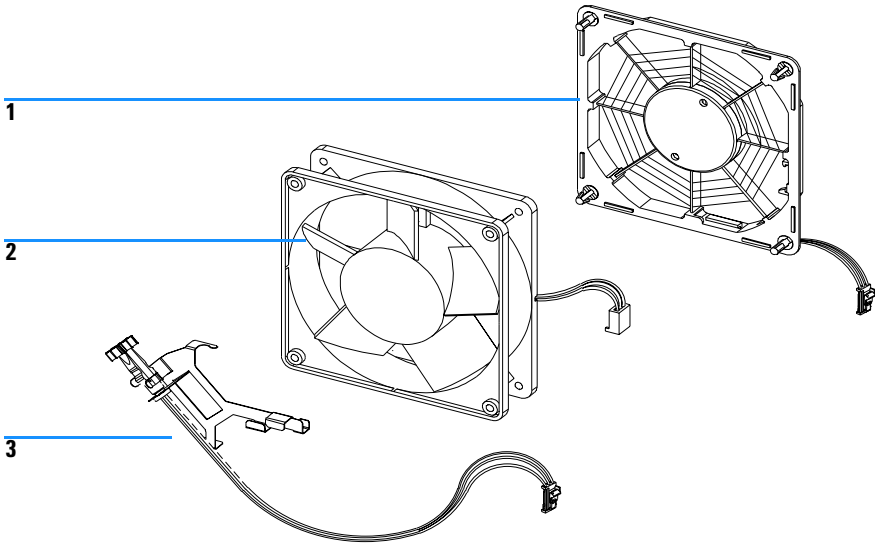


Figure 32 Fan assembly parts

Holmium Oxide Filter

Table 46 Holmium oxide filter assembly parts

Item	Description	Part Number
1	Holmium oxide filter	79880-22711
2	Holmium oxide filter lever	G1315-45001
3	Spring	1460-1510
4	Holmium oxide filter motor assembly, includes items 2 and 4	G1315-68700

NOTE When the filter motor has been removed, the filter lever should not be reused. Use always a new filter lever to assure correct fit on the filter motor shaft.

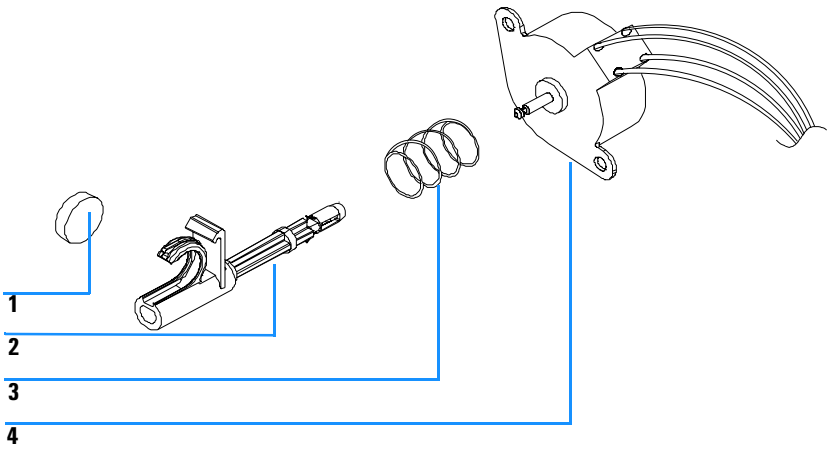


Figure 33 Holmium oxide filter parts

Diode Array Detector Cover Parts

Table 47 Diode array detector cover parts

Item	Description	Part Number
1	Name plate Serial Number (w/o serial number)	5042-1314
2	Plastics, includes base, sides and top	5062-8565
3	Name plate Agilent 1100 Series	5042-1381
4	Front cover	5062-8582

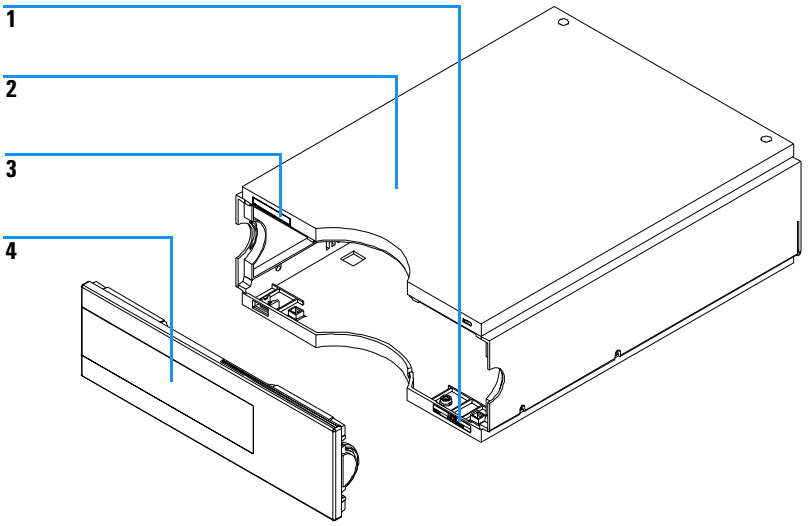


Figure 34 Diode array detector cover parts

Common Parts

This chapter shows the parts identification of the common parts like rear panel, power and status light pipes, leak parts, foam parts, sheet metal kit and the different accessory kits. For cables see page 121.

Control Module (G1323B)

Table 48 Control Module Parts

Description	Part Number
Control Module, replacement part including cable	G1323-67001
Plastic Housing Kit, includes front, back and a clamp	5062-8583
CAN cable Agilent 1100 module to control module	G1323-81600

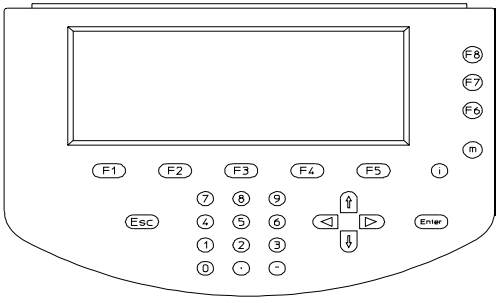


Figure 35 Control Module

Rear panel

Table 49 Rear panel

Item	Description	Part Number
1	Standoff — remote connector	1251-7788
2	Nut M14 — analog output	2940-0256
3	Screw, M4, 7 mm lg — power supply	0515-0910
4	Standoff — GPIB connector	0380-0643

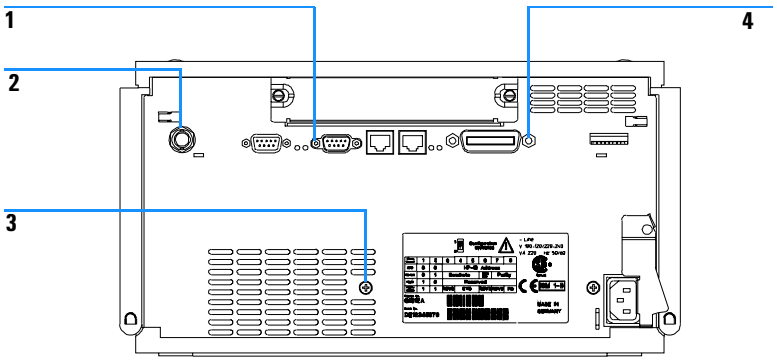


Figure 36 Rear panel

Power and Status Light Pipes

Table 50 Power and status light pipes

Item	Description	Part Number
1	Light pipe — power switch	5041-8382
2	Power switch coupler	5041-8383
3	Light pipe — status lamp	5041-8384
4	Power switch button	5041-8381

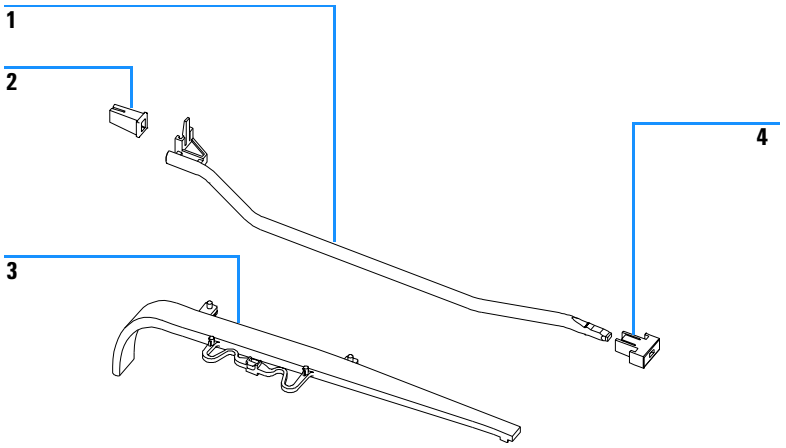


Figure 37 Power and Status Light Pipes

Leak Parts

Table 51 Leak parts

Item	Description	Part Number
1	Holder, leak funnel	5041-8389
2	Leak funnel	5041-8388
3	Tube clip	5041-8387
4	Leak plane, pump Leak plane, degasser Leak plane, ALS, WPS Leak plane, TCC, for details see page 100 Leak plane, DAD	5041-8390 G1379-47300 G1313-44501 G1316-68700 G1315-45501
5	Leak sensor	5061-3356
6	Corrugated waste tube (reorder pack), 5m	5062-2463

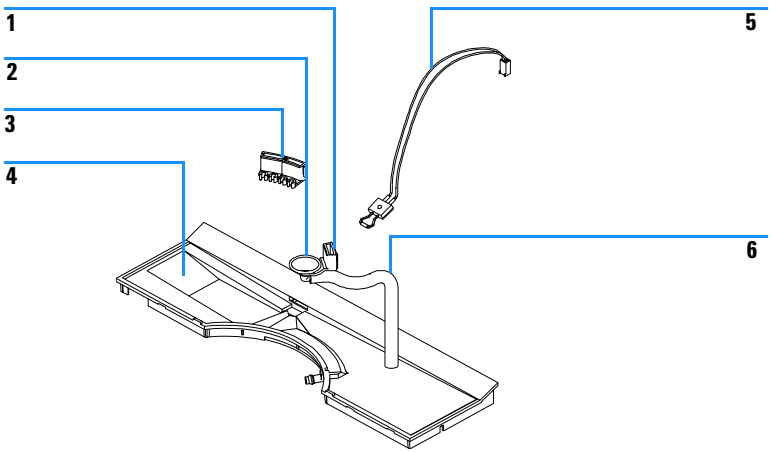


Figure 38 Leak parts

Foam parts

Table 52 Foam parts

Description	Part number
Foam kit for the capillary pump G1376A Foam kit for the micro autosampler G1389A Foam kit for the micro well-plate sampler G1377A Foam kit for the thermostatted column compartment G1316A Foam kit for the diode array detector G1315B (the foam kit includes the base and the top)	G1312-68702 G1313-68702 5064-8248 G1316-68702 G1315-68722
Interface board guides (board guides for the G1376A/ G1389A/ G1377A/ G1315B)	5041-8395
Bushing for pump drive	1520-0404
Damper kit (includes 7 bumpers) for DAD	G1315-68706

Sheet metal kit

Table 53 Sheet metal kit

Description	Part number
Sheet metal kit for micro degasser G1379A	G1379-68701
Sheet metal kit for the capillary pump G1376A	G1376-68701
Sheet metal kit for micro autosampler G1389A	G1329-68701
Sheet metal kit for micro well-plate sampler G1377A	G1367-68701
Sheet metal kit for thermostatted column compartment G1316A	G1316-68701
Sheet metal kit for diode array detector G1315B (the sheet metal kit includes top, base, and front cover)	G1315-68721
Cover screw	5022-2112
Slot cover (at the rear of the module)	5001-3772

Micro Degasser Accessory Kit

Table 54 G1329A - Micro degasser accessory kit contents G1322-68705

Description	Part Number
Fitting tool	0100-1710
Solvent tubing kit (4 tubes degasser to pump)	G1322-67300
Syringe *	5062-8534
Syringe adapter	9301-1337
Waste tube †	5062-2463

* Reorder number (pack of 10)

† Reorder number (5m)

Capillary Pump Preventive Maintenance Kit G1376-68710

Table 55 Capillary pump preventive maintenance kit G1376-68710

Description	Part Number
Gold seal outlet	5001-3707
Plastic cap	5042-1346
Seal	0905-1503
Filter	3150-0450
0.5 µm SST frit	5022-2185

Capillary Pump Accessory Kit

Table 56 Capillary pump accessory kit G1376-68705

Description	Part Number
Insert tool	01018-23702
SST Solvent inlet filter (x4)	01018-60025
Waste tube	0890-1760
SST replacement frit (0.5 µm)	5022-2185
Wrench open end 7/16 - 1/2 inch (x 2)	8710-0806
Wrench open end 1/4 - 5/16 inch (x1)	8710-0510
Wrench open end 14 mm (x 1)	8710-1924
Wrench open end 4 mm, (x 1)	8710-1534
Hex key 2.5 mm, 15 cm long, straight handle (x 1)	8710-2412
Hex key 3.0 mm, 12 cm long (x 1)	8710-2411
Hex key 4.0 mm, 15 cm long, T handle (x 1)	8710-2392
Torque adapter	G1315-45003
CAN cable (1 m long)	5181-1519
Purge valve assembly	G1311-60009
Purge valve holder	G1312-23200
Screw for the purge valve holder	0515-0175
FS to Inj valve cap. (550 mm, 50 µm)	G1375-87310
ESD wrist strap	no PN

Micro Well-plate Sampler Accessory Kit G1377-68705

Table 57 Micro well-plate sampler accessory kit G1377-68705

Description	Quantity	Part Number
96 well-plate 0.5 ml, PP (pack of 10)	1	5042-1386
Tubing assembly	1	5063-6527
Filter kit	1	5064-8240
CAN cable, 1 m	1	5181-1519
Vials, screw cap 100/pk	1	5182-0716
Blue screw caps 100/pk	1	5182-0717
Valve catalog	1	5988-2999
Hex key 9/64 inch (for injection-valve screws)	1	8710-0060
Wrenches 1/4 – 5/16 inch	2	8710-0510
Wrench 4.0 mm open end	1	8710-1534
Rheotool socket wrench 1/4 inch	1	8710-2391
Hex key 4.0 mm, 15 cm long, T-handle	1	8710-2392
Hex key 9/64 inch, 15 cm long, T-handle	1	8710-2394
Hex key 2.5 mm, 15 cm long, straight handle	1	8710-2412
Hex key 2.0 mm	1	8710-2438
ESD wrist strap	1	9300-1408
Torque adapter	1	G1315-45003
Air channel adapter	1	G1329-43200
Capillary sampler-column (500 mm 0.05 mm ID)	1	G1375-87304
40 µl Loop capillary	1	G1377-87300
WPS leak kit	1	G1367-60006

Thermostatted Micro Autosampler Accessory Kit

Table 58 Thermostatted micro autosampler accessory kit G1329-68715

Description	Part Number
Tubing assembly	no PN
CAN cable, 1 m long	5181-1519
Screw cap vials, clear 100/pk	5182-0714
Blue screw caps 100/pk	5182-0717
Label halftray	no PN
Fitting	5061-3303
Hex Key	8710-0060
Wrench 4 mm both ends	8710-1534
Wrenches 1/4 - 5/16 inch	8710-0510
Rheotool socket wrench 1/4 inch	8710-2391
Hex key 4 mm, 15 cm long, T-handle	8710-2392
Hex key 9/64 mm, 15 cm long, T- handle	8710-2394
Hex key 2.5 mm, 15 cm long, straight handle	8710-2412
ESD wrist strap	no PN
Finger caps x3 (reorder gives pack of 15)	5063-6506
Torque adapter	G1315-45003
Air channel adapter	G1329-43200
Extended loop capillary 0.25 mm, 180 mm	G1329-87302
Fused silica capillary 0.050 mm, 500 mm	G1375-87304

Column Compartment with Micro Column Selection Valve Accessory Kit

Table 59 Column compartment with micro column selection valve (CSV) accessory kit G1316-68725

Description	Part Number
Column holder (x2)	5001-3702
Fingertight fitting (x2) reorder number (10 /pack)	5065-4422
Column identification tag (x1) reorder number (3 / pack)	5062-8588
Corrugated waste tube reorder number (5 m)	5062-2463
CAN cable	5181-1516
Wrenches 1/4 - 5/16 inch	8710-0510
ESD wrist strap	no PN
Column clip (x4) reorder number (6 / pack)	5063-6526
Fused silica/PEEK capillary 50 µm, 280 mm (x4)	G1375-87309
Column holder (x2)	5001-3702
Fingertight fitting (x2) reorder number (10 /pack)	5065-4422
Column identification tag (x1) reorder number (3 / pack)	5062-8588
Corrugated waste tube reorder number (5 m)	5062-2463

DAD Accessory Kit

Table 60 DAD accessory kit G1315-68705

Description	Part Number
Accessory kit	G1315-68705
Tubing assembly waste 1.2 m lg	no PN
Tubing flexible (to waste) 2 m lg	0890-1713
Fitting male PEEK, Qty=1	0100-1516
Capillary column – detector 380 mm lg, 0.17 i.d. includes items 4, 5 and 6 (not assembled)	G1315-87311
Ferrule front SST, qty=10	5180-4108
Ferrule back SST, qty=10	5180-4114
Fitting SST, qty=10	5061-3303
Hex key set 1 – 5 mm	8710-0641
Wrench open end 1/4 – 5/16 inch	8710-0510
Wrench open end 4 mm	8710-1534
ESD wrist strap	no PN

Cables

WARNING **Never use cables other than the ones supplied by Agilent Technologies to ensure proper functionality and compliance with safety or EMC regulations.**

Table 61 offers an overview over all cables supplied:

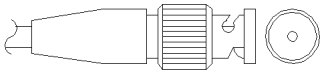
Table 61 Cables overview

Type	Description	Part Number
Analog cables	3390/2/3 integrators	01040-60101
	3394/6 integrators	35900-60750
	35900A A/D converter	35900-60750
	General purpose (spade lugs)	01046-60105
	3390/2/3 integrators	01040-60101
Remote cables	3390 integrator	01046-60203
	3392/3 integrators	01046-60206
	3394 integrator	01046-60210
	3396A (Series I) integrator	03394-60600
	3396 Series II / 3395A integrator, see page 127	
	3396 Series III / 3395B integrator	03396-61010
	Agilent 1100 / 1050 modules / 1046A FLD	5061-3378
	1046A FLD	5061-3378
	35900A A/D converter	5061-3378
	1040 diode-array detector	01046-60202
	1090 liquid chromatographs	01046-60202
	Signal distribution module	01046-60202

Table 61 Cables overview (continued)

Type	Description	Part Number
BCD cables	3392/3 integrators	18594-60510
	3396 integrator	03396-60560
	General purpose (spade Lugs)	18594-60520
Auxiliary	Agilent 1100 Series vacuum degasser	G1322-61600
CAN cables	Agilent 1100 module to module, 0.5 m	5181-1516
	Agilent 1100 module to module, 1 m	5181-1519
	Agilent 1100 module to control module	G1323-81600
External contacts	Agilent 1100 Series interface board to general purpose	G1103-61611
GPIB cable	Agilent 1100 module to Agilent ChemStation, 1 m	10833A
	Agilent 1100 module to Agilent ChemStation, 2 m	10833B
RS-232 cable	Agilent 1100 module to a computer This kit contains a 9-pin female to 9-pin female Null Modem (printer) cable and one adapter.	34398A
LAN cable	Twisted pair cross over LAN cable, 10 feet long (for point to point connection)	5183-4649
	Category 5 UTP cable, 8 m long (for hub connections)	G1530-61480

Analog Cables



One end of these cables provides a BNC connector to be connected to Agilent 1100 Series modules. The other end depends on the instrument to which connection is being made.

Table 62 Agilent 1100 to 3390/2/3 integrators

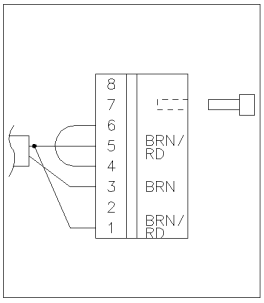
Connector 01040-60101	Pin 3390/2/3	Pin Agilent 1100	Signal Name
	**1**	Shield	Ground
	2		Not connected
	3	Center	Signal +
	4		Connected to pin 6
	5	Shield	Analog -
	6		Connected to pin 4
	7		Key
	8		Not connected

Table 63 Agilent 1100 to 3394/6 integrators

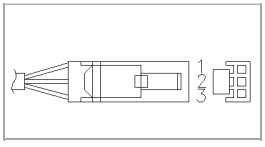
Connector 35900-60750	Pin 3394/6	Pin Agilent 1100	Signal Name
	**1**		Not connected
	2	Shield	Analog -
	3	Center	Analog +

Table 64 Agilent 1100 to BNC connector

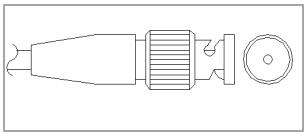
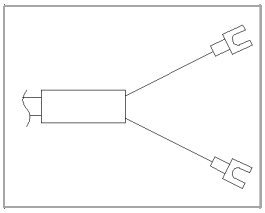
Connector 8120-1840	Pin BNC	Pin Agilent 1100	Signal Name
	Shield	Shield	Analog -
	Center	Center	Analog +

Table 65 Agilent 1100 to general purpose

Connector 01046-60105	Pin 3394/6	Pin Agilent 1100	Signal Name
	**1**		Not connected
	2	Black	Analog -
	3	Red	Analog +

Remote Cables

One end of these cables provides a Agilent Technologies APG (Analytical Products Group) remote connector to be connected to Agilent 1100 Series modules. The other end depends on the instrument to be connected to.

Table 66 Agilent 1100 to 3390 integrators

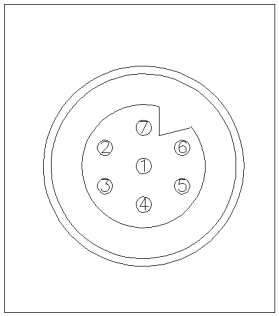
Connector 01046-60203	Pin 3390	Pin Agilent 1100	Signal Name	Active (TTL)
	2	1 - White	Digital ground	
	NC	2 - Brown	Prepare run	Low
	7	3 - Gray	Start	Low
	NC	4 - Blue	Shut down	Low
	NC	5 - Pink	Not connected	
	NC	6 - Yellow	Power on	High
	NC	7 - Red	Ready	High
	NC	8 - Green	Stop	Low
	NC	9 - Black	Start request	Low

Table 67 Agilent 1100 to 3392/3 integrators

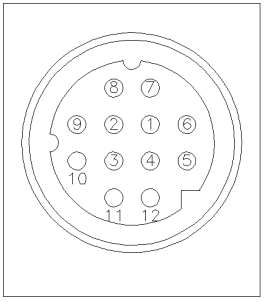
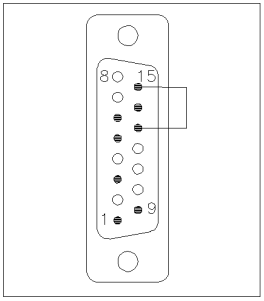
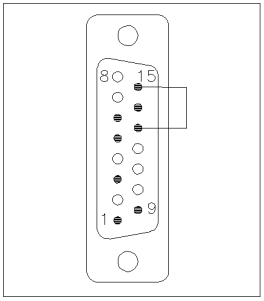
Connector 01046-60206	Pin 3392/3	Pin Agilent 1100	Signal Name	Active (TTL)
	3	1 - White	Digital ground	
	NC	2 - Brown	Prepare run	Low
	11	3 - Gray	Start	Low
	NC	4 - Blue	Shut down	Low
	NC	5 - Pink	Not connected	
	NC	6 - Yellow	Power on	High
	9	7 - Red	Ready	High
4 - Key	1	8 - Green	Stop	Low
	NC	9 - Black	Start request	Low

Table 68 Agilent 1100 to 3394 integrators

Connector 01046-60210	Pin 3394	Pin Agilent 1100	Signal Name	Active (TTL)
	9	1 - White	Digital ground	
	NC	2 - Brown	Prepare run	Low
	3	3 - Gray	Start	Low
	NC	4 - Blue	Shut down	Low
	NC	5 - Pink	Not connected	
	NC	6 - Yellow	Power on	High
	5,14	7 - Red	Ready	High
	6	8 - Green	Stop	Low
	1	9 - Black	Start request	Low
	13, 15		Not connected	

NOTE START and STOP are connected via diodes to pin 3 of the 3394 connector.

Table 69 Agilent 1100 to 3396A integrators

Connector 03394-60600	Pin 3394	Pin Agilent 1100	Signal Name	Active (TTL)
	9	1 - White	Digital ground	
	NC	2 - Brown	Prepare run	Low
	3	3 - Gray	Start	Low
	NC	4 - Blue	Shut down	Low
	NC	5 - Pink	Not connected	
	NC	6 - Yellow	Power on	High
	5,14	7 - Red	Ready	High
	1	8 - Green	Stop	Low
	NC	9 - Black	Start request	Low
	13, 15		Not connected	

Agilent 1100 to 3396 Series II / 3395A Integrators

Use the cable 03394-60600 and cut pin #5 on the integrator side. Otherwise the integrator prints START; not ready.

Table 70 Agilent 1100 to 3396 Series III / 3395B integrators

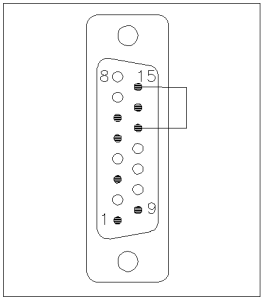
Connector 03396-61010	Pin 33XX	Pin Agilent 1100	Signal Name	Active (TTL)
	9	1 - White	Digital ground	
	NC	2 - Brown	Prepare run	Low
	3	3 - Gray	Start	Low
	NC	4 - Blue	Shut down	Low
	NC	5 - Pink	Not connected	
	NC	6 - Yellow	Power on	High
	14	7 - Red	Ready	High
	4	8 - Green	Stop	Low
	NC	9 - Black	Start request	Low
	13, 15		Not connected	

Table 71 Agilent 1100 to HP 1050, HP 1046A or Agilent 35900 A/D converters

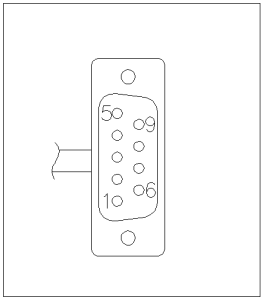
Connector 5061-3378	Pin HP 1050 / ...	Pin Agilent 1100	Signal Name	Active (TTL)
	1 - White	1 - White	Digital ground	
	2 - Brown	2 - Brown	Prepare run	Low
	3 - Gray	3 - Gray	Start	Low
	4 - Blue	4 - Blue	Shut down	Low
	5 - Pink	5 - Pink	Not connected	
	6 - Yellow	6 - Yellow	Power on	High
	7 - Red	7 - Red	Ready	High
	8 - Green	8 - Green	Stop	Low
	9 - Black	9 - Black	Start request	Low

Table 72 Agilent 1100 to HP 1090 LC, HP 1040 DAD or signal distribution module

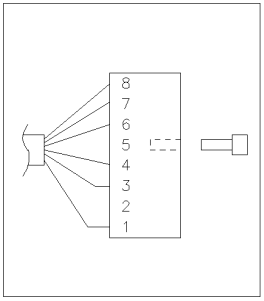
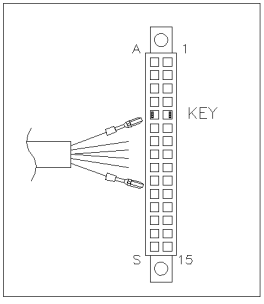
Connector 01046-60202	Pin HP 1090	Pin Agilent 1100	Signal Name	Active (TTL)
	1	1 - White	Digital ground	
	NC	2 - Brown	Prepare run	Low
	4	3 - Gray	Start	Low
	7	4 - Blue	Shut down	Low
	8	5 - Pink	Not connected	
	NC	6 - Yellow	Power on	High
	3	7 - Red	Ready	High
5 - Key	6	8 - Green	Stop	Low
	NC	9 - Black	Start request	Low

Table 73 Agilent 1100 to general purpose

Connector 01046-60201	Pin Universal	Pin Agilent 1100	Signal Name	Active (TTL)
		1 - White	Digital ground	
		2 - Brown	Prepare run	Low
		3 - Gray	Start	Low
		4 - Blue	Shut down	Low
		5 - Pink	Not connected	
		6 - Yellow	Power on	High
		7 - Red	Ready	High
		8 - Green	Stop	Low
		9 - Black	Start request	Low

BCD Cables

One end of these cables provides a 15-pin BCD connector to be connected to the Agilent 1100 Series modules. The other end depends on the instrument to be connected to.

Table 74 Agilent 1100 to 3392/3 integrators

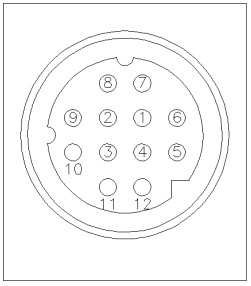
Connector 18584-60510	Pin 3392/3	Pin Agilent 1100	Signal Name	BCD Digit
 6 - Key	10	1	BCD 5	20
	11	2	BCD 7	80
	3	3	BCD 6	40
	9	4	BCD 4	10
	7	5	BCD0	1
	5	6	BCD 3	8
	12	7	BCD 2	4
	4	8	BCD 1	2
	1	9	Digital ground	
	2	15	+ 5 V	Low

Table 75 Agilent 1100 to 3396 integrators

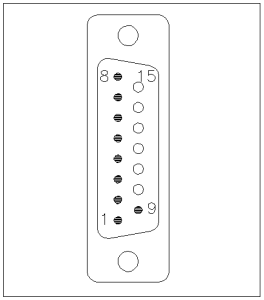
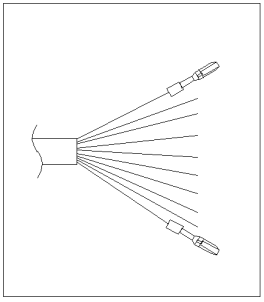
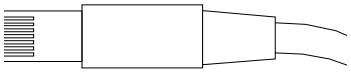
Connector 03396-60560	Pin 3392/3	Pin Agilent 1100	Signal Name	BCD Digit
	1	1	BCD 5	20
	2	2	BCD 7	80
	3	3	BCD 6	40
	4	4	BCD 4	10
	5	5	BCD0	1
	6	6	BCD 3	8
	7	7	BCD 2	4
	8	8	BCD 1	2
	9	9	Digital ground	
	NC	15	+ 5 V	Low

Table 76 Agilent 1100 to general purpose

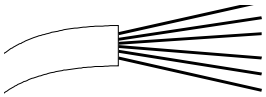
Connector 18594-60520	Wire Color	Pin Agilent 1100	Signal Name	BCD Digit
	Green	1	BCD 5	20
	Violet	2	BCD 7	80
	Blue	3	BCD 6	40
	Yellow	4	BCD 4	10
	Black	5	BCD0	1
	Orange	6	BCD 3	8
	Red	7	BCD 2	4
	Brown	8	BCD 1	2
	Gray	9	Digital ground	
	White	15	+5 Vt	Low

Auxiliary Cable

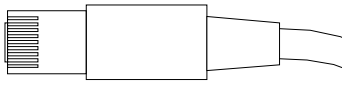


One end of this cable provides a modular plug to be connected to the Agilent 1100 Series vacuum degasser. The other end is for general purpose.

Table 77 Agilent 1100 series degasser to general purposes

Connector G1322-61600	Color	Pin Agilent 1100	Signal Name
	White	1	Ground
	Brown	2	Pressure signal
	Green	3	
	Yellow	4	
	Grey	5	DC + 5 V IN
	Pink	6	Vent

CAN Cable

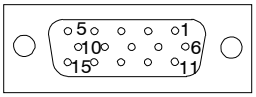


Both ends of this cable provide a modular plug to be connected to Agilent 1100 Series module's CAN-bus connectors

Table 78 CAN-bus connectors

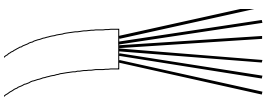
Agilent 1100 module to module, 0.5 m	5181-1516
Agilent 1100 module to module, 1 m	5181-1519
Agilent 1100 module to control module	G1323-81600

External Contact Cable



One end of this cable provides a 15-pin plug to be connected to Agilent 1100 Series module's interface board. The other end is for general purpose.

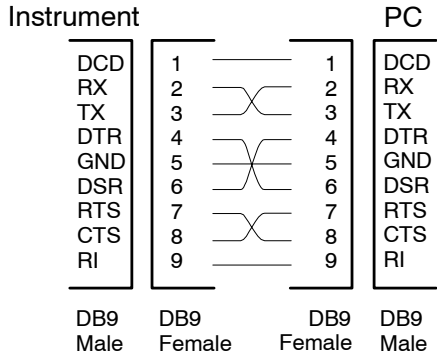
Table 79 Agilent 1100 series interface board to general purposes

Connector G1103-61611	Color	Pin Agilent 1100	Signal Name
	White	1	EXT 1
	Brown	2	EXT 1
	Green	3	EXT 2
	Yellow	4	EXT 2
	Grey	5	EXT 3
	Pink	6	EXT 3
	Blue	7	EXT 4
	Red	8	EXT 4
	Black	9	Not connected
	Violet	10	Not connected
	Grey/pink	11	Not connected
	Red/blue	12	Not connected
	White/green	13	Not connected
	Brown/green	14	Not connected
	White/yellow	156	Not connected

RS-232 Cable Kit

This kit contains a 9-pin female to 9-pin female Null Modem (printer) cable and one adapter. Use the cable and adapter to connect Agilent Technologies instruments with 9-pin male RS-232 connectors to most PCs or printers.

Agilent 1100 module to PC



LAN Cables

Recommended Cables

For point to point connection (not using a network hub) use a twisted pair cross over LAN cable (P/N 5183-4649, 10 feet long).

For standard network connections using a hub use category 5 UTP cables, (P/N G1530-61480, 8 m long).

6 Options

Extended Flow Range Kit (G1376-69707) 136
0.1 - 2.5 ml/min Flow Capillary Kit (5065-4495) 139
Micro Column Switching Valve G1388A#055 143
500 nl Flow Cell Kit G1315-68714 153

This chapter describes the different options available for the capillary LC System.

Extended Flow Range Kit (G1376-69707)

The extended flow range kit described in Table 80 lets you adapt your capillary pump to enable it to work with flows up to 100 µl/min. In order to decrease the system pressure when you increase the flow until 100 µl/min some capillaries must be changed. These capillaries, (8, 9, 10, 11, 13) are shaded in Figure 39 on page 137.

Table 80 Extended flow range kit G1376-68707 content

Item	Description	Part Number
	Flowsensor (100 µl)	G1376-60002
8	Capillary EMPV to flowsensor (220 mm, 100 µm)	G1375-87305
9	Capillary flow sensor to injection valve (550 mm100 µm)	G1375-87306
13	Capillary injection valve to analytical head (200 mm, 100 µm)	G1375-87312
10	Capillary injection valve to column (500 mm, 75 µm)	G1375-87311
11	Capillary column to detector (400 mm, 75 µm)	G1375-87308

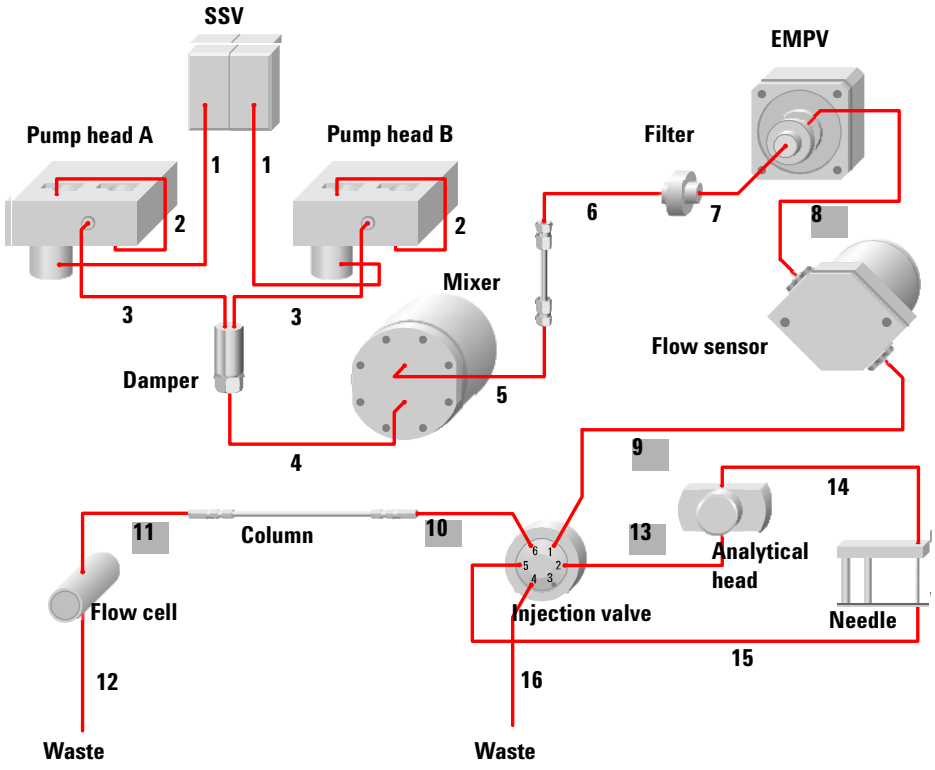


Figure 39 Capillary pump flow diagram

Installing the Extended Flow Range Kit

Frequency	When the flow rate is higher than 20 µl/min
Tools required	4 mm open wrench (8710-1534) Torque adapter G1315-45003 1/4 - 5/16 inch open wrench (8710-0510) 2.5 mm hex key (8710-2412)
Parts required	Extended flow range kit (G1376-69707)

1 Using the 4 mm / 1/4 - 5/16 inch open wrenches disconnect the capillaries 8, 9, 10, 11 and 13. Refer to Figure 39 on page 137 to identify their location.

2 Remove the 20 µl flow sensor by unscrewing the 2 holding screws with the 2.5 mm hex key.

3 Install the 100 ul flow sensor and screw the 2 holding screws with the 2.5 mm hex key.

4 Using the 4 mm / 1/4 - 5/16 inch open wrenches connect the capillaries 8, 9, 10, 11 and 13 (refer to Figure 39 on page 137) to identify their location

NOTE If the pressure drop in the system is not to high you can leave the capillary G1375-68703 between the column and the detector (item 8). Otherwise change it as recommended with the capillary G1375-87308.

NOTE To successfully install the capillaries and avoid the risk of a leak go to Chapter 3, "Capillaries and Fittings.

0.1 - 2.5 ml/min Flow Capillary Kit (5065-4495)

It is possible to use the capillary pump with a flow rate higher than 100 µl/min. For this the pump must be used in the normal mode and some hardware modifications are necessary.

From 100 to 200 µl/min, bypassing the electronic flow control is needed. No other hardware modifications are necessary.

From 200 to 2500 µl/min bypassing the electronic flow sensor, installing the manual purge valve (supplied with the accessory kit), changing the UV detector cell and changing the capillaries in the flow path is needed.

The 0.1 to 2.5 ml/min flow capillary kit (5065-4495) include all the capillaries needed to work with a flow from 200 to 2500 µl/min.

Table 81 0.1 - 2.5 ml/min flow capillary kit 5065-4495 content

Part number	Diameter (µm)	Pressure drop (Bar)	Length (mm)	Material	Volume (µl)	Fitting type
G1375-87400	170	2	280	SST *	6.4	A/A
G1375-87318	125	15	550	PFS **	6.8	B/C
G1375-87312	100	13	200	PFS	1.6	B/C
G1329-87302	250	3	1800	SST	88	B/B
G1375-87312	100	13	200	PFS	1.6	B/C
G1375-87306	100	37	550	PFS	4.4	C/B
G1316-87300	170	<1	70	SST	1.6	A/A

* SST: stainless steel

* * PFS: Peek coated fused silica

Installing the 0.1 - 2.5 ml/min flow capillary kit

Frequency	When the flow rate is higher than 200 µl/min
Tools required	4 mm open wrench (8710-1534) Torque adapter G1315-45003 1/4 - 5/16 inch open wrench (8710-0510) 14 mm wrench (8710-1924)
Parts required	Extended flow range kit (G1376-69707) Purge valve assembly G1311-60009 (supplied in the accessory kit G1376-68705) Purge valve holder G1312-23200 (supplied in the accessory kit G1376-68705) Purge valve holder screw 0515-0175 (supplied in the accessory kit G1376-68705) Washer 2190-0586 (supplied in the accessory kit G1376-68705)

1 Switch off the pump module.

2 Disconnect the capillary 01090-87308 between the mixer and the filter.

3 Connect the capillary G1375-87400 to the mixer outlet.

4 Connect the other end of the capillary G1375-87400 to the purge. valve holder.

5 Install the purge valve holder on the pump head of channel A and fix it with the screw.

6 Screw the purge valve assembly into the purge valve holder and locate the outlet and waste.

7 Use the 14 mm wrench to tighten the purge valve assembly.

8 Remove the waste tube from the EMPV and install it to the waste outlet of the purge valve.

9 Disconnect the capillary on the injection valve (port 1).

10 Connect the capillary G1375-87318 between the purge valve and the injection valve (port 1).

11 Replace the capillary between the injection valve and the analytical head with the capillary G1375-87312.

12 Replace the loop capillary with the capillary G1329-87302 if you have a micro autosampler (G1389A) or with the capillary G1377-87300 if you have a micro well-plate sampler (G1377/78A).

NOTE Don't forget to change the loop or syringe size to 40 µl in the injector configuration windows of the user interface.

Needle seat assembly must be G1329-87101 with the 100 µm capillary (G1389A).
Needle seat assembly must be G1375-87317 with the 100 µm capillary ((G1377/78A).

13 Replace the capillary between the injection valve (port 6) and the column with the capillary G1375-87312. If a thermostat (G1330A/B) is in place use the capillary G1375-87306.

NOTE Above a flow of 200 µl/min it is recommend to rout the flow through the Peltier. The capillary G1316-87300 is then connected between the Peltier "out" and the column inlet.

14 Replace the capillary between the column and the detector with the capillary G1315-87311.

NOTE Replace the 500 nl flow cell with the standard flow cell (G1315-60012), the semi micro flow cell (G1315-6001) or the high pressure flow cell (G1315-60015)

The pressures in Table 82 and Table 83 are indicated values, measured on one system. These values can differ from one system to another.

Table 82 Pressure drop at 2.5 ml/min for different concentrations (no column)

% of organic phase	Pressure (bar) for Methanol	Pressure (bar) for Acetonitrile
0	165	162
20	170	169
40	158	154
60	132	128
80	100	95
100	75	72

Table 83 Pressure drop for different columns and different flow rates, with a gradient from 0 to 100% Acetonitrile in 10 minutes.

Column (id and length)	Flow rate (ml/min)	Pressure (bar)	
100 x 2.1 mm	0.4	92 (max.)	38 (lowest)
100 x 2.1 mm	0.8	174 (max.)	68 (lowest)
125 x 4.0 mm	1.0	131 (max.)	45(lowest)
125 x 4.0 mm	1.5	190 (max.)	67 (lowest)
100 x 4.6 mm	2.0	213 (max.)	86 (lowest)
100 x 4.6 mm	2.5	272 (max.)	112 (lowest)

Micro Column Switching Valve G1388A#055

The micro column switching valve allows to work with 2 columns and to select either the one or the other. The offline column is sealed by connecting head to rail. Switching should be done when the flow is off and the pressure is zero. Figure 40 shows the flow diagram when column 1 is active. Figure 41 shows the flow diagram when column 2 is active.

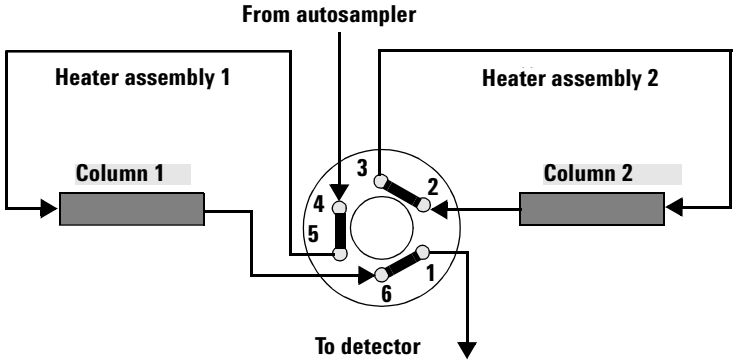


Figure 40 Column 1 Active

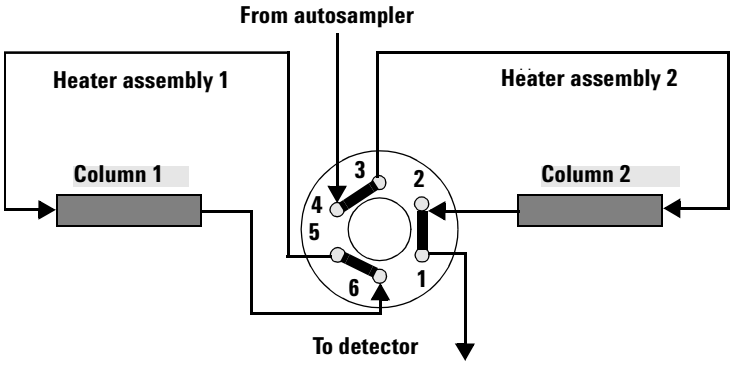


Figure 41 Column 2 Active

The micro column switching valve allows also to work with a column back-flushing. The sample is injected into series-connected precolumn and analytical column. After the valve has switched, the analytical column flow continues in normal direction. Only the precolumn is back-flushed, eluting highly retained peaks directly to the detector.

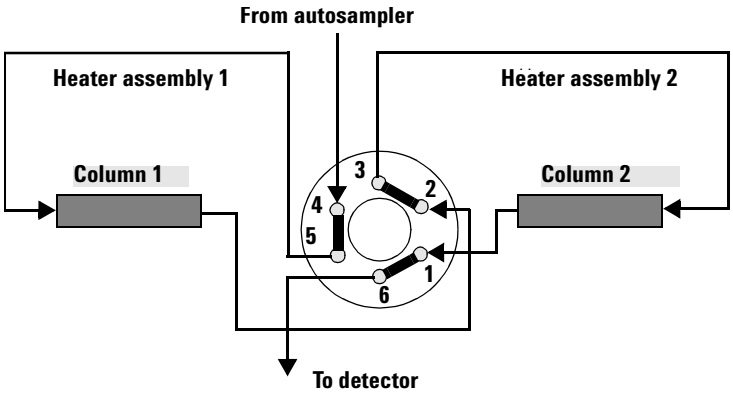


Figure 42 Precolumn back-flushing

Parts Identification for Micro Column Switching Valve

Table 84 Micro column switching valve

Item	Description	Part Number
	Column switching valve (complete assembly)	0101-1051
	Fused silica capillaries, 50 µm, 280 mm)	G1375-87309
	Micro Valve Fitting Kit, (includes 6 fittings, 2 plugs)	5065-4410
1	Stator screw	1535-4857
2	Stator Head	0100-2089
3	Stator ring	No PN
4	Rotor seal 3 grooves (Vespel)	0100-2087

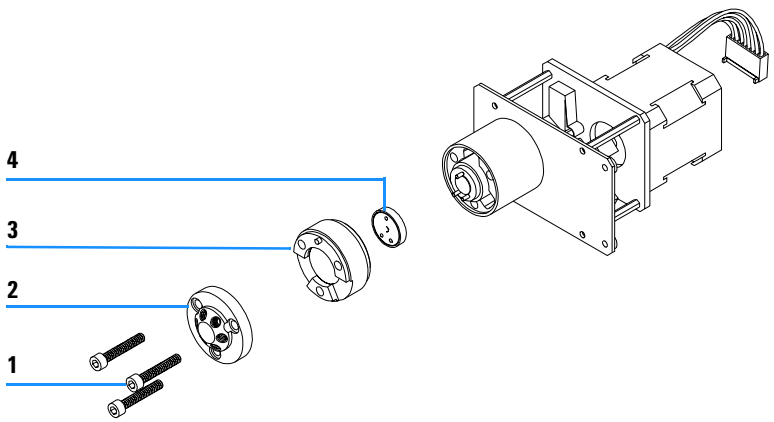
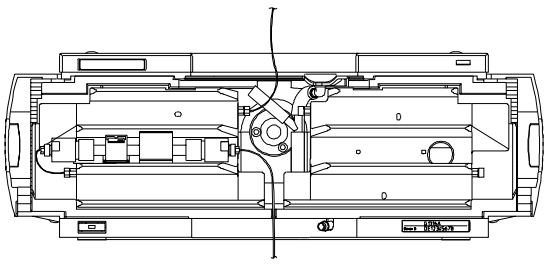


Figure 43 Micro column switching valve

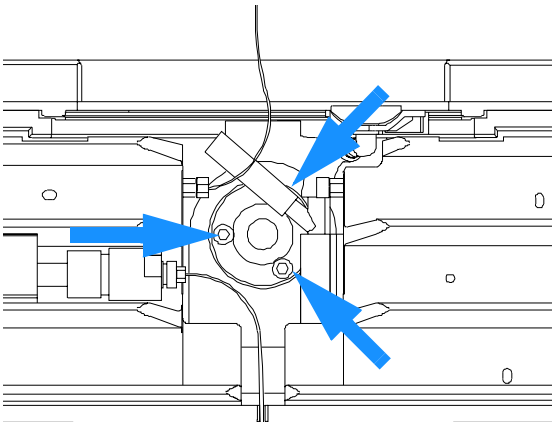
Replacing Rotor Seal of Micro Column Switching Valve

Frequency	If valve leaks
Tools required	5.5 mm wrench 9/64 inch hex key
Parts required	Refer to "500 nl Flow Cell Kit G1315-68714" on page 153.

1 Remove capillaries from ports 1, 5, and 6.



2 Loosen each fixing stator screws two turns at a time. Remove bolts from head.



15 Remove the stator head and the rotor seal.

16 Install the new rotor seal, re-install the stator head.

17 Insert the stator screws in the stator head. Tighten the screws alternately two turns at a time until the stator head is secure.

18 Reconnect the pump capillaries to the valve ports. Slide the waste tube into the waste holder in the leak tray.

19 Perform a pressure-tightness test to ensure the valve is pressure tight to 400 bar.

Removing the Micro Column Switching Valve

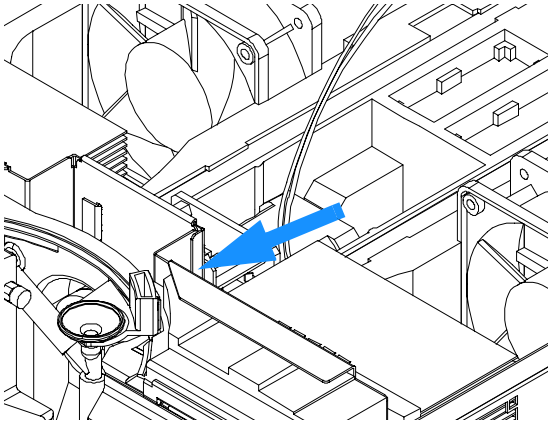
When required If valve failed or bottom foam part has to be removed for other replacements

Tools required Screwdriver Pozidriv 1 PT3
Wrench 5.5 mm for capillary connections

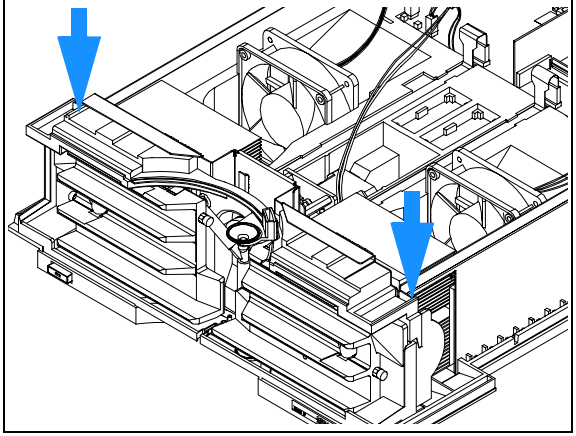
Preparations for this procedure:

- Turn off the column compartment.
- Disconnect the power cable.
- Disconnect capillaries.
- Remove column compartment from stack and place it on the working bench.
- Remove the front cover, top cover and top foam section.

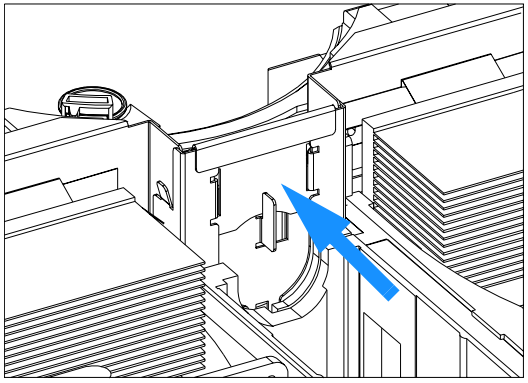
1 Disconnect the grounding connection of the valve at the Z-panel.



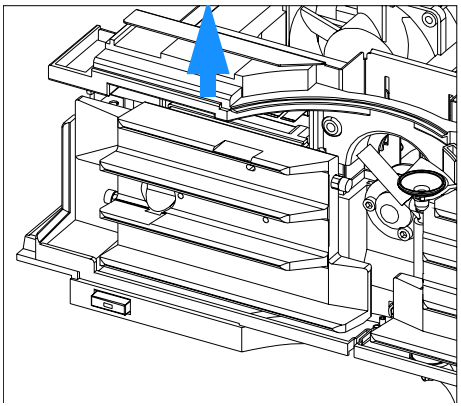
2 Unscrew the Z-panel.



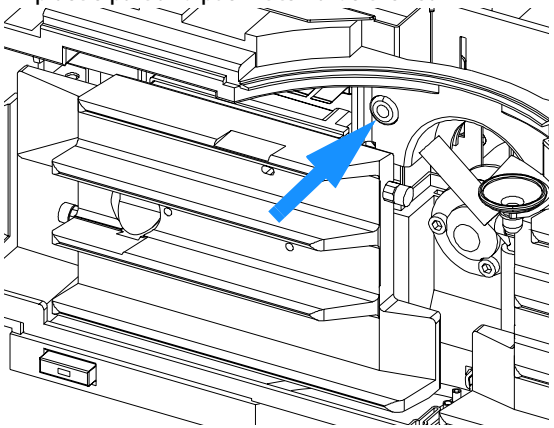
3 Press against the rear of the Z-panel to release the metal plate from the guide and pull it carefully upwards.



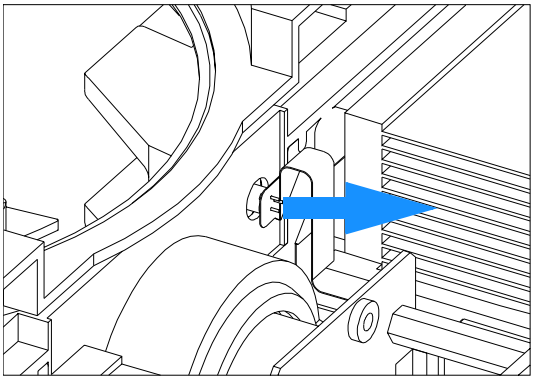
4 Lift the Z-panel together with the top plastic panel half-way out of the guide.



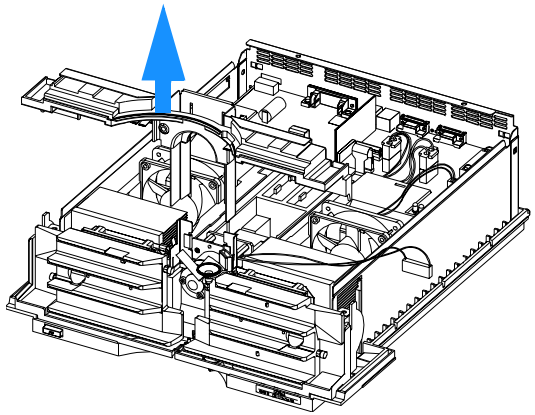
5 Locate the ambient temperature sensor in the top plastic part and push it towards the rear.



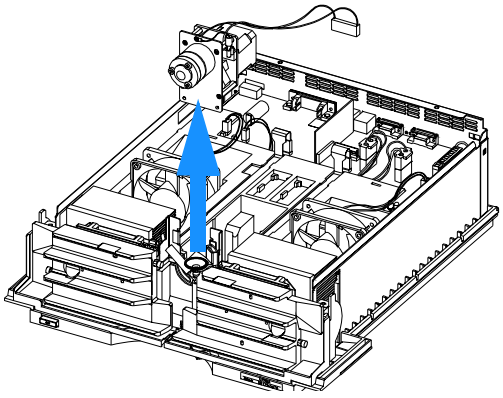
6 Carefully remove the ambient temperature sensor plugged into the rear of the top plastic panel.



7 Pull the top plastic panel together with the Z-panel completely out of the guide.



8 Remove the Valve from its location.



For the installation refer to "Installing the Micro Column Switching Valve" on page 150.

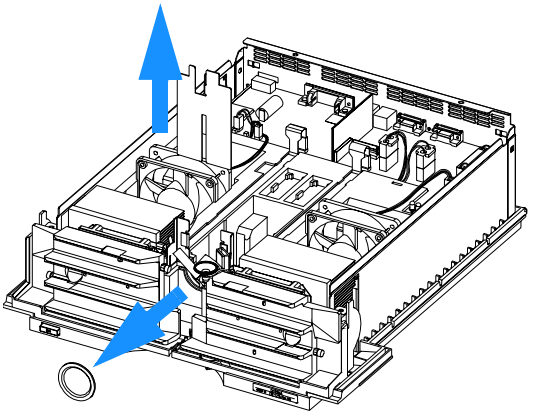
Installing the Micro Column Switching Valve

When required	For first time installation or after it was removed
Tools required	Screwdriver Pozidriv 1 PT3 Wrench 5.5 mm for capillary connections

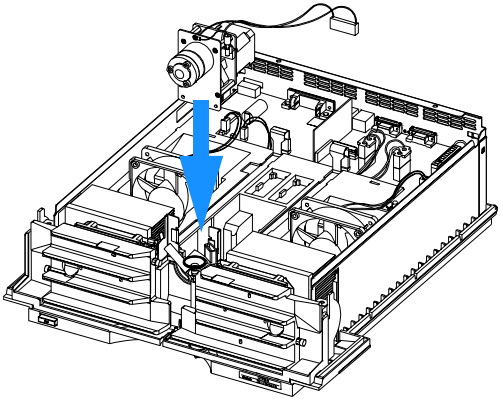
Preparations for this procedure are:

- The column compartment is open as described in "Removing the Micro Column Switching Valve" on page 147

1 If no column switching valve was installed, remove the RFI-shield and the plastic cover (no longer used).



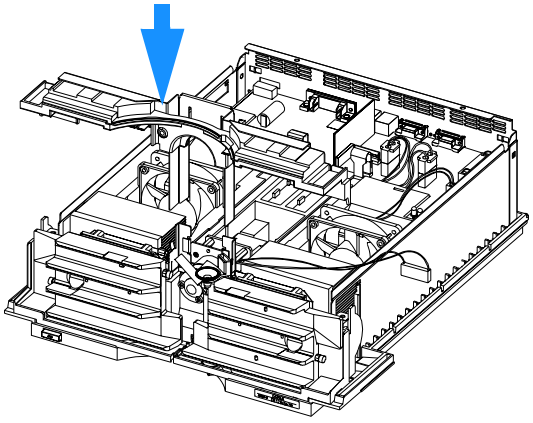
2 Replace the valve into its location.



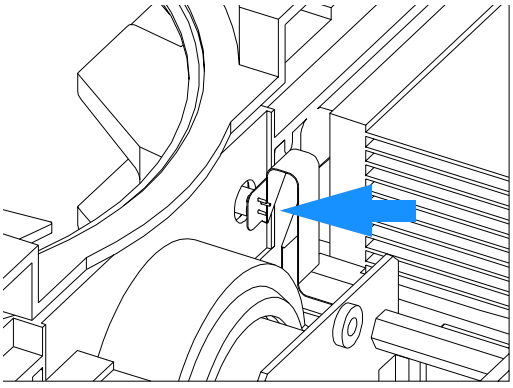
Note

Ensure that during the next steps the flexible cables close to the heat exchanger assemblies are not damaged.

3 Carefully insert the top plastic panel together with the Z-panel into the guide and press it half-way down.



4 Carefully plug the ambient temperature sensor into the rear of the top plastic panel.

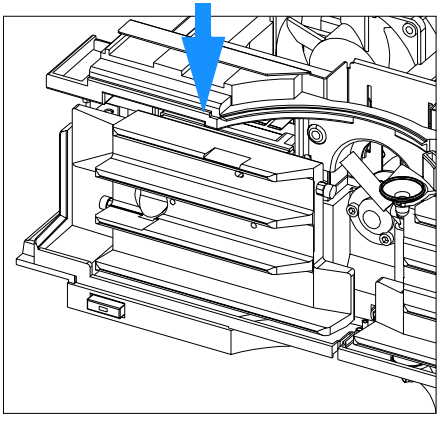


Note

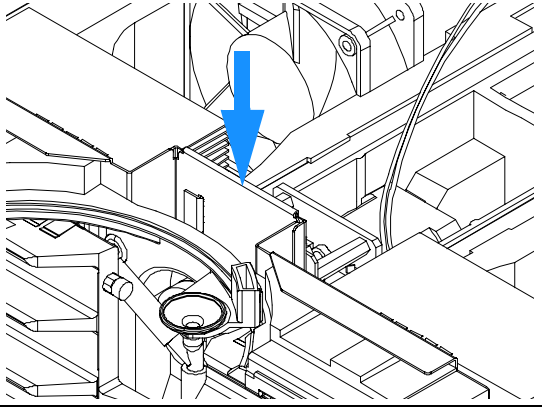
Ensure that the ambient temperature sensor is completely plugged into the rear of the top plastic panel.

Ensure that during the next steps the flexible cables close to the heat exchanger assemblies are not damaged.

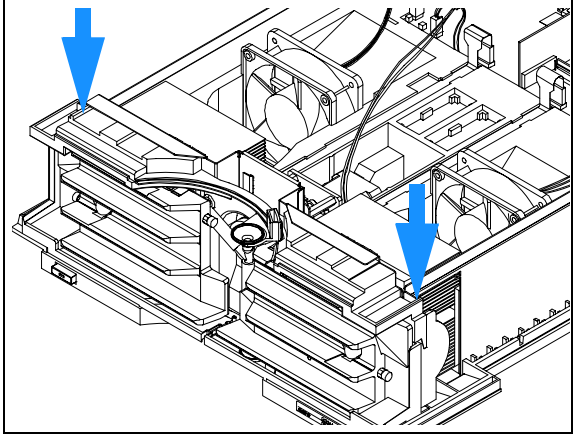
5 Press the Z-panel together with the Top Plastic Panel completely down.



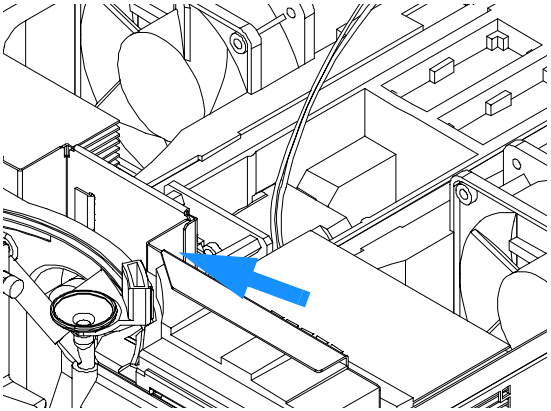
6 Press down completely until it clicks into its holding position.



7 Fix the Z-panel with the two screws.



8 Reconnect the grounding connection of the valve at the Z-panel.



9 Replace the foam section, the top cover and front cover.

10 Replace the column compartment into stack.

11 Reconnect capillaries.

12 Reconnect the power cable.

13 Turn on the column compartment.

500 nl Flow Cell Kit G1315-68714

This section describes the 500 nl flow cell for Agilent 1100 Series diode array detector and multiple wavelength detector.

Features

- small dispersion through:
  - 500 nl, 10 mm pathlength flow cell
  - novel PEEK jacked quartz capillaries (inlet 50 µm i.d., outlet 75 µm i.d.)
  - novel “top sealing” fitting concept
- low RI sensitivity for flat baselines at low flow gradients with the use of an optical reference wavelength
- good sensitivity through 10 mm pathlength and acceptable noise level
- the cartridge type concept allows customer specific capillary connections up to the front end of the quartz cell

Performance Specification

Table 85 Performance specification 500 nl flow cell

Type	Specification
Pathlength	10 mm
Volume	500 nl
Pressure	Operating range 0–5 MPa (0–50 bar, 0–725 psi)
internal diameter of capillaries	inlet: 50 µm, outlet: 75 µm
length. of capillaries	inlet 400 mm, outlet 700 mm
material of capillaries	quartz with PEEK coating
material in contact with solvent	quartz, PEEK
Noise specification	2 - 3 of times higher than the 10 mm STD flow cell at 0.05 ml/min

Special Information for Maintenance

The supplied parts with the flow cell allow different fittings and capillaries, see Figure 44. Before fitting it to the flow cell, think about which type you want to use. Depending on this you may have to use special parts mentioned in the procedure.

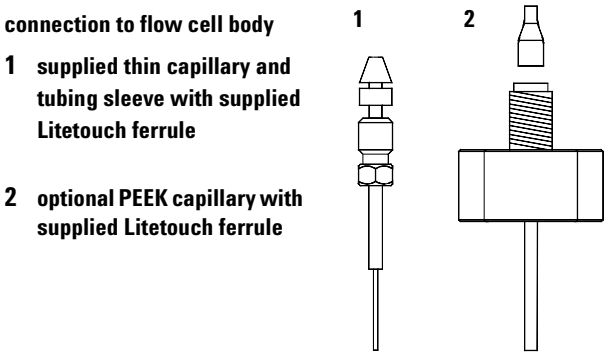

connection to flow cell body
1 supplied thin capillary and tubing sleeve with supplied Litetouch ferrule
2 optional PEEK capillary with supplied Litetouch ferrule
1
2

Figure 44 Types of fittings and capillaries

CAUTION

The supplied PEEK capillaries for this flow cell have special surface treatment at both ends. DO NOT shorten the capillaries. This may cause leakage or damage.

Bending radius smaller than 10 mm may break the quartz capillary inside the PEEK jacket. In this case high pressure may burst the PEEK jacket.

CAUTION

Always wear eye protection when working close to polymer tubing that is under pressure.

Do not use PEEK tubing with tetrahydrofuran (THF) or concentrated nitric acid (except for short flushing procedures) and sulfuric acid.

Methylene chloride and dimethyl sulfoxide cause PEEK to swell.

During assembling take care for cleanliness.

The capillary may be reused by carefully removing of the ferrules using a pair of side-cutters or the original Upchurch tool, see Figure 45.

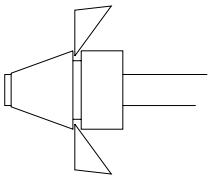


Figure 45 Removing Ferrule

The cell fittings are factory installed and tested for leakage. These connections should not be used as an instrument interface. It should be opened only for maintenance and/or special adaptions.

CAUTION Do not overtighten the cell fittings. This may break the cell quartz body.

With the instrument accessory kit comes a 4-mm wrench and with the Sealing Kit a special adapter. Both together work as a torque wrench with pre-defined torque (maximum allowed torque for the cell fittings is 0.7 Nm). It can be used to tighten the capillary fittings at the flow cell body. The wrench has to be plugged into the adapter as shown in Figure 46.

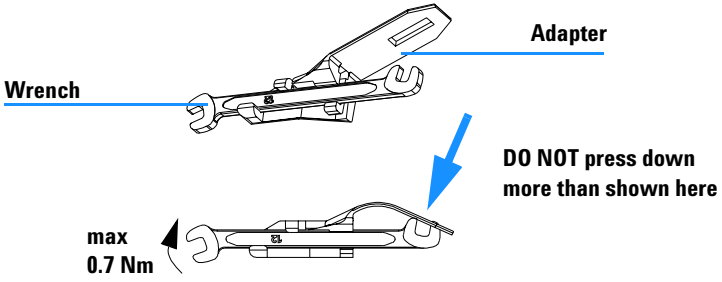


Figure 46 Wrench plus Torque Adapter

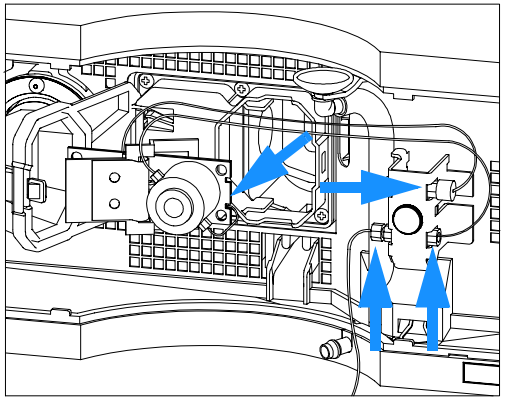
Installation of the Flow Cell

The flow cell is supplied with blank capillaries at the instrument side to allow the use of different fittings, see Figure 44 on page 154.

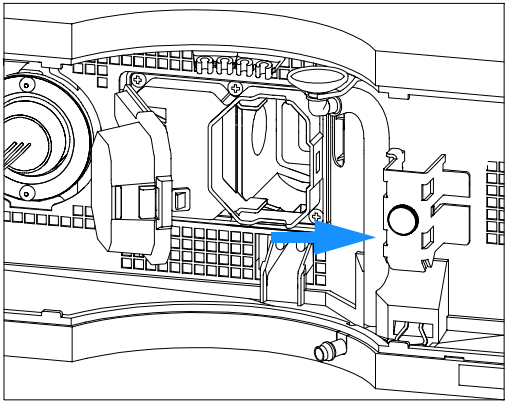
If you are using small i.d capillary columns from e.g. LC Packings, see also “Connecting Small I.D. Capillaries” on page 160.

The steps below describe the connection to the internal hydraulic connector and might not be used in case the capillaries are routed directly to the column and/or waste

1 Disconnect the capillaries from the capillary holder and remove the flow cell.



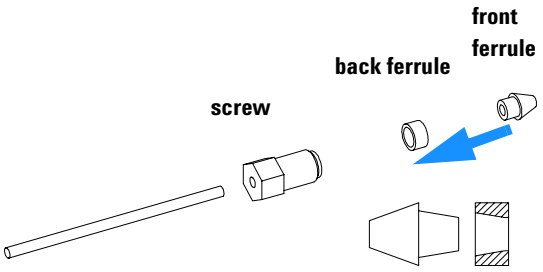
2 Insert the union “Top Adjust” (supplied with the kit) into the lower capillary holder position. This will be used as tool for fixing the ferrules at the capillaries.



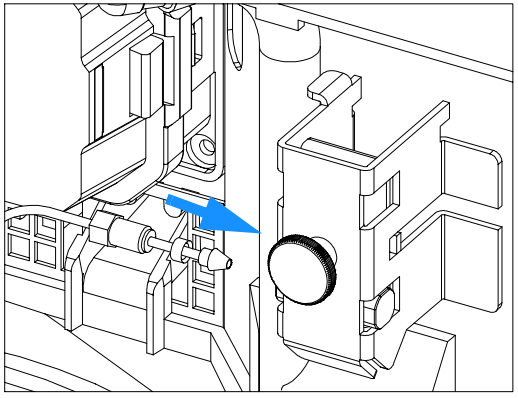
Step 3 and 4 have to be done for each of the two flow cell capillaries, if this connection type is desired.

There is no stop within the union "Top Seal" for plane capillaries. Therefore one prefixed ferrule is required at least.

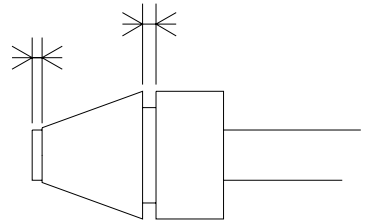
3 Slide the screw, back ferrule and front ferrule onto the PEEK capillary (see detail for correct direction). This is for cell side only!



4 Carefully press the capillary into the adjustment union. Then tight the fitting screw moderately to fix the ferrule.



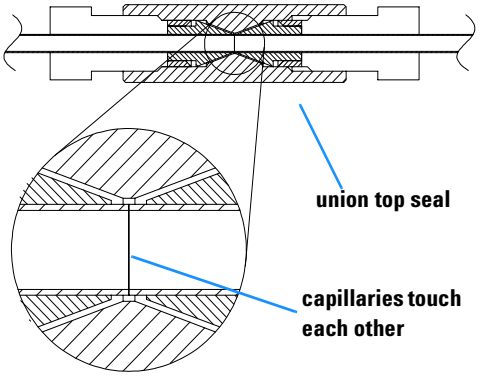
5 Appearance of the prefixed ferrule.



NOTE

The correct torque for prefixing the ferrules in the "union top-adjust" and for sealing the cell fittings is 0.5 - 0.7 Nm. For the cell screws, the torque adapter can be used, see Figure 46 on page 155.

6 The figure below shows the sealing principle within the union “top seal”, hand tightened before torque is applied.

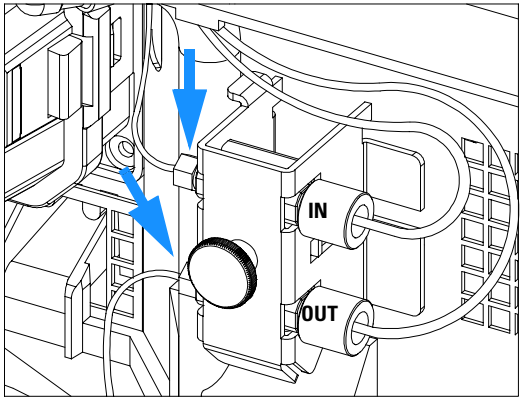


Depending on the fitting type you select, the figure in step 7 may look different.

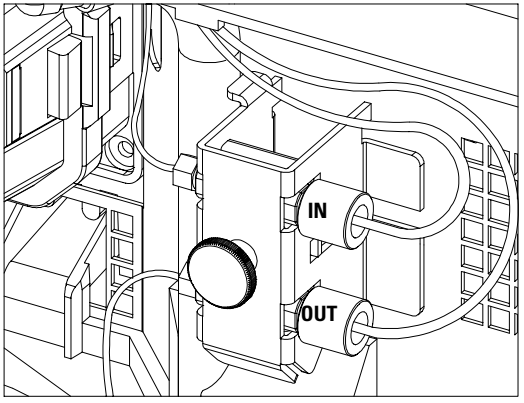
The figures in step 7 and 8 show alternatively the supplied PEEK fittings and the two supplied (top sealing) unions from the kit (the original union(s) must be replaced).

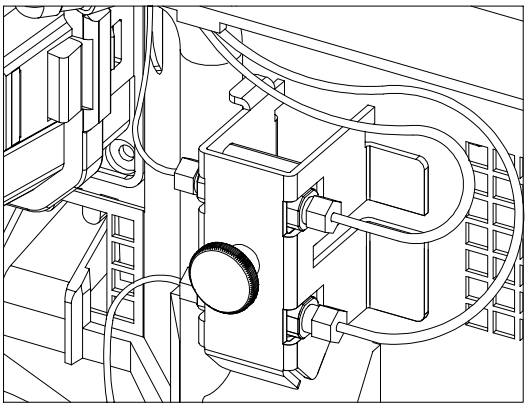
The figure in step 9 shows the connection with the supplied SST fittings.

7 Insert the flow cell into the instrument and connect the waste and column capillary.



8 Insert the PEEK capillaries from the flow cell body together with the PEEK fitting into the supplied unions and tighten it.



9 Insert the PEEK capillaries from the flow cell body together with the SST fitting, ferrule and cone into the union and tighten it. 	**Remove the flow cell and perform a leak test.** **If no leak is observed, install the flow cell and you are ready to work.** **Make sure that the flow cell assembly is inserted correctly and fits perfectly in the optical unit (especially when PEEK capillaries are used).**

Connecting Small I.D. Capillaries

Columns from e.g. LC Packings have capillary connections which are of very small i.d. with FEP sleeves. To use it with the 500 nl flow cell use the information below.

NOTE A PEEK sleeve with the appropriate internal and outer diameter is required to fit the SST fitting and the ferrules on the quartz capillary.

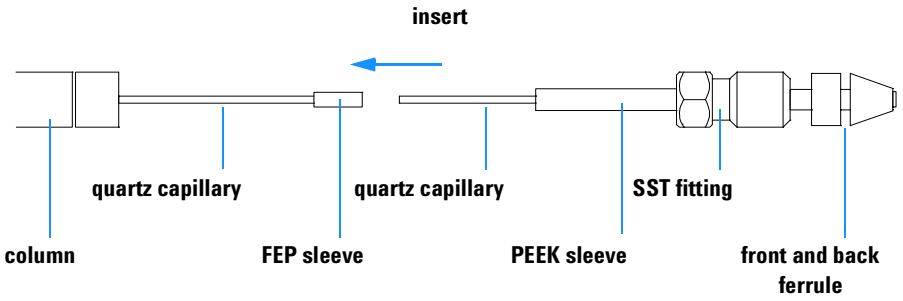
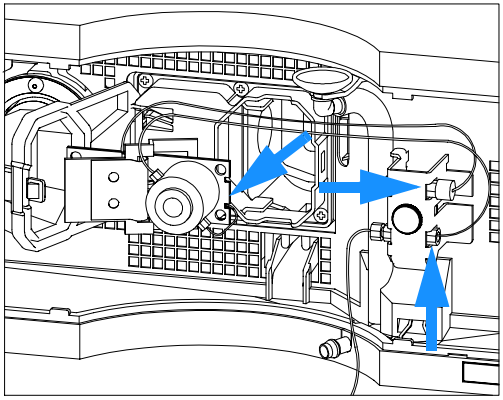


Figure 47 Connecting small i.d. capillaries

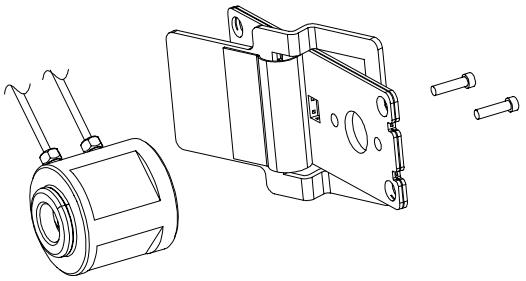
Replacing or Cleaning Parts

CAUTION The quartz block can be cleaned with alcohol. DO NOT touch the inlet and outlet windows at the quartz block.

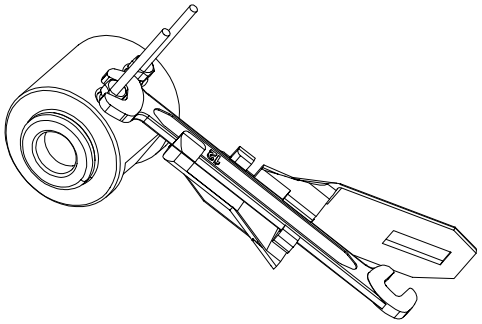
1 Disconnect the capillaries from the capillary holder and remove the flow cell.



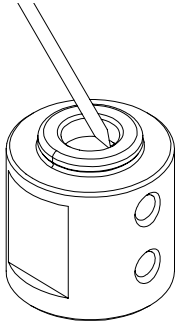
2 Unscrew the cell body from the holder.



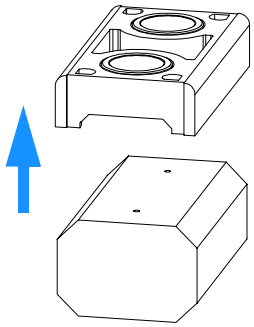
3 Unscrew the capillaries from the flow cell. DO NOT use the adapter at this time!



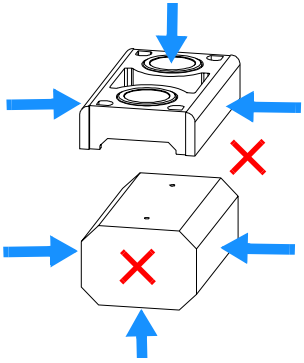
4 Using a toothpick, press on the plastic part and slide the quartz body out of the cell housing.



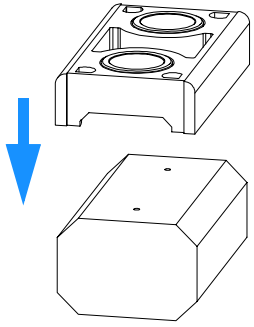
5 The quartz body and the cell seal assembly can be separated for cleaning purpose.



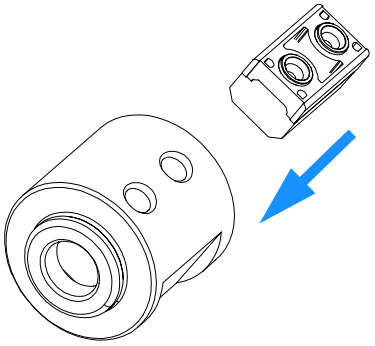
6 This figure shows the correct holding of the quartz body and the cell seal assembly.



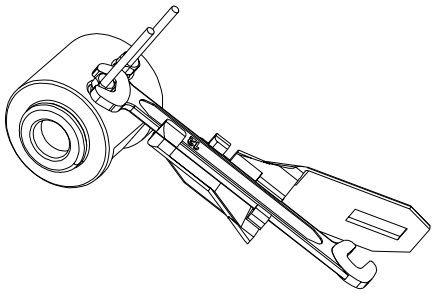
7 Replace the cell seal assembly onto the quartz body. It is recommended to use a new assembly.



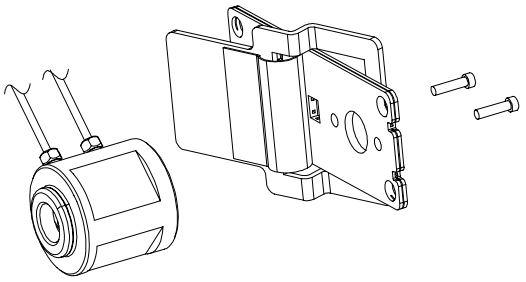
8 Slide the quartz body completely into the cell body to the front stop (use for example a toothpick).



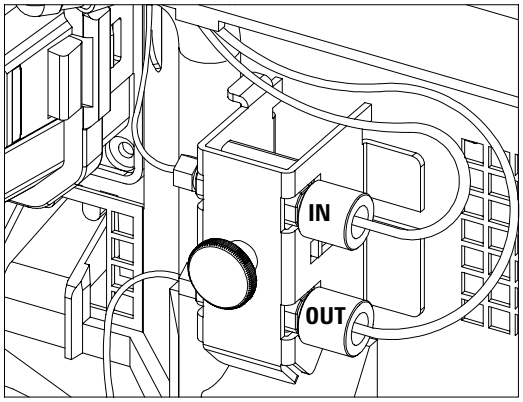
9 Insert the flow cell capillaries and tighten them fingertight.Use of the wrench and torque adapter as described page 155 and tighten the fittings alternate



10 Reassemble the flow cell body to the holder.



11 Re-install the flow cell and connect the capillaries to the union holder.



Remove the flow cell and perform a leak test.

If no leak is observed, install the flow cell and you are ready to work.

7
Performance Specifications

Performance Specifications Agilent 1100 Series Capillary Pump 166
Performance Specifications Agilent 1100 Series Micro Vacuum Degasser 168
Performance Specifications Agilent 1100 Series Thermostatted Micro Autosampler 169
Performance specification Agilent 1100 Series Micro Well-plate Sampler 170
Performance Specifications Agilent 1100 Thermostatted Column Compartment. 171
Performance Specifications Agilent 1100 Series DAD 172

This chapter summarizes performance specifications of the capillary pump.

Performance Specifications Agilent 1100 Series Capillary Pump

Table 86 Performance Specification Agilent 1100 Series Capillary LC System

Type	Specification
System delay volume	Typically 5 µl from EFC to column head, for flow rates up to 20 µl/min (default setup). Typically 14 µl from EFC to column head, for flow rates up to 100 µl/min (default setup).

Table 87 Performance Specification Agilent 1100 Series Capillary Pump

Type	Specification
Hydraulic system	Two dual piston in series, with proprietary servo-controlled variable stroke drive, floating piston, active inlet valve, solvent selection valve and electronic flow control for flow rates up to 100 µl/min
Settable column flow range	0.01 – 20 µl/min 0.01 – 100 µl/min (with the extended flow range kit) 0.001 – 2.5 µl/min (with the electronic flow control bypassed)
Recommended column flow range	1 – 20 µl/min 10 – 100 µl/min (with extended flow range kit) 0.1 – 2.5 ml/min (with the electronic flow sensor bypassed)
Column flow precision	< 0.7 % RSD or 0.03 % SD (typically 0.4 % RSD or 0.02 % SD), at 10 µl/min and 50 µl/min column flow (based on RT, default setting)
Optimum composition range	1 to 99% or 5 µl/min per channel (primary flow), whatever is greater
Composition precision	< 0.2 % SD, at 10 µl/min (20 µl flow sensor), 50 µl/min (100 µl flow sensor) and 1 ml/min (normal mode) default setting

Table 87 Performance Specification Agilent 1100 Series Capillary Pump (continued)

Type	Specification
Delay volume	Typically 3 µl from the electronic flow control to the pump outlet for flow rates up to 20 µl/min. Typically 12 µl from the electronic flow control to the pump outlet for flow rates up to 100 µl. for flow rates up to 100 µl/min and electronic flow control active: primary flow path 180 - 480 µl without mixer, 600 - 900 µl with mixer (system pressure dependant) Typically 180 to 480 µl (system pressure dependent) without mixer for flow rates up to 2.5 ml/min. (Mixer delay volume 420 µl)
Pressure range	20 to 400 bar (5880 psi) system pressure
Compressibility compensation	User-selectable, based on mobile phase compressibility
Recommended pH range	1.0 – 8.5, solvents with pH < 2.3 should not contain acids which attack stainless steel. Upper pH range is limited by fused silica capillaries.
Control and data evaluation	Agilent ChemStation for LC
Analog output	For pressure monitoring, 2 mV/bar, one output
Communications	Controller-area network (CAN), GPIB, RS-232C, APG Remote: ready, start, stop and shut-down signals, LAN optional
Safety and maintenance	Extensive diagnostics, error detection and display (through control module and Agilent ChemStation), leak detection, safe leak handling, leak output signal for shutdown of pumping system. Low voltages in major maintenance areas.
GLP features	Early maintenance feedback (EMF) for continuous tracking of instrument usage in terms of seal wear and volume of pumped mobile phase with user-settable limits and feedback messages. Electronic records of maintenance and errors.
Housing	All materials recyclable.

Performance Specifications Agilent 1100 Series Micro Vacuum Degasser

Table 88 Performance Specifications Agilent 1100 Micro Vacuum Degasser

Type	Specification
Flow rate	0 – 5 ml/min per channel (5 – 10 ml/min at reduced degassing performance)
Number of channels	4
Internal volume per channel	Typically 1 ml per channel
Materials in contact with solvent	PTFE – FEP – PEEK
pH range	1 – 14
Analog output (AUX)	For pressure monitoring, range 0 – 3 V
Evaporation of solvents into the atmosphere	< 200 µg/m^3 Acetonitrile and Methanol certification by IAS.

Performance Specifications Agilent 1100 Series Thermostatted Micro Autosampler

Table 89 Performance Specifications Agilent 1100 Series Thermostatted Micro Autosampler

Type	Specification
Sample capacity	100 x 2 ml vials in 1 tray. Microvials (100 or 300 µl) with sleeves (reduced cooling performance with microvials)
Settable injection volume	0.01 to 8 µl with small loop capillary 0.01 to 40 µl with extended loop capillary
Precision	Typically < 0.5 % RSD from 5 – 40 µl, Typically < 1 % RSD from 1 – 5 µl Typically < 3 % RSD from 0.2 – 1 µl
Minimum sample volume	1 µl from 5 µl sample in 100 µl microvial, or 1 µl from 10 µl sample in 300 µl microvial
Carryover	Typically < 0.1 % without automated needle wash. Typically < 0.05 % with external needle cleaning and 1ul injection volume
Sample viscosity range	0.2 – 5 cp
Recommended pH-range	1.0 – 8.5, solvents with pH < 2.3 should not contain acids which attack stainless steel. Upper pH range is limited by fused silica capillaries.
Material in contact with solvent	Stainless steel, sapphire, PTFE, PEEK, fused silica, Vespel
GLP features	Early maintenance feedback (EMF), electronic records of maintenance and errors
Communications	Controller-area network (CAN). GPIB (IEEE-448), RS232C, APG-remote standard, optional four external contact closures and BCD vial number output
Safety features	Leak detection and safe leak handling, low voltages in maintenance areas, error detection and display
Housing	All material recyclable

Performance specification Agilent 1100 Series Micro Well-plate Sampler

Table 90 Performance specifications Agilent 1100 series micro well-plate sampler

Type	Specification
GLP features	Early maintenance feedback (EMF), electronic records of maintenance and errors
Communications	Controller-area network (CAN). RS232C, APG-remote standard, optional four external contact closures and BCD vial number output
Safety features	Leak detection and safe leak handling, low voltages in maintenance areas, error detection and display
Injection range	0.01 – 8 µl in 0.01 µl increments with the small loop capillary 0.01 – 40 µl in 0.01 µl increments with the extended loop capillary
Precision	Typically < 0.5 % RSD of peak areas from 5 – 40 µl, Typically < 1 % RSD from 1 – 5 µl Typically < 3 % RSD from 0.2 – 1 µl
Sample viscosity range	0.2 – 5 cp
Sample capacity	2 × well-plates (MTP) + 10 × 2 ml vials 100 x 2 ml in one tray 40 x 2 ml in half tray
Injection cycle time	Typically < 30 s using following standard conditions: Default draw speed: 4 µl/min Default eject speed: 10 µl/min Injection volume: 0.1 µl
Carry-over	Typically < 0.05 % using the following conditions: Column: 150 x 0.5 mm Hypersil ODS, 3 µm Mobile phase: Water/Acetonitrile = 85/15 Column Flow rate: 13 µl/min Injection volume: 1 µl caffeine (=25ng caffeine), 1 µl water to test carryover Outside wash of needle before injection: 20 sec with water using flush port

Performance Specifications Agilent 1100 Thermostatted Column Compartment.

All specifications in Table 91 are valid for distilled water at ambient temperature (25 °C), set point at 40 °C and a flow range from 0.2–5 ml/min.

For flow rates below 100 µl/min the column bracket must be installed

Table 91 Performance Specifications Agilent 1100 Series Thermostatted Column Compartment

Type	Specification
Temperature range	10 degrees below ambient to 80 °C
Temperature stability	± 0.15 °C
Column capacity	Three 25 cm - NOTE: With fused silica capillaries connected, length limited by bend radii of capillary
Warm-up/cool-down time	5 minutes from ambient to 40 °C 10 minutes from 40 – 20 °C
Internal volume	3 µl left heat exchanger 6 µl right heat exchanger
Communications	Controller-area network (CAN), GPIB, RS-232C, APG Remote: ready, start, stop and shut-down signals, LAN optional
Safety and maintenance	Extensive diagnostics, error detection and display (through control module and Agilent ChemStation), leak detection, safe leak handling, leak output signal for shutdown of pumping system. Low voltages in major maintenance areas.
GLP features	Column-identification module for GLP documentation of column type, see “Column-Identification System”
Housing	All materials recyclable.

Performance Specifications Agilent 1100 Series DAD

Reference conditions for data of Table 92:

- cell path length 10 mm, response time 2 s,
- flow 1 ml/min LC-grade Methanol,
- slit width 4 nm.

Linearity measured with caffeine at 265 nm.

Table 92 Performance Specifications Agilent 1100 Series Diode Array Detector

Type	Specification	Comments
Detection type	1024-element photodiode array	
Light source	Deuterium and tungsten lamps	
Wavelength range	190 – 950 nm	
Short term noise (ASTM)* Single and Multi-Wavelength	Typically ± 3 × 10^{-5} AU at 254 nm at flow rates <100 µl/min	For the 500 nl flow cell the noise is 2-3 times higher than with standard flow cell
Drift	2 × 10^{-3} AU/hr at 254 nm	
Linear absorbance range	> 2 AU (upper limit)	
Wavelength accuracy	± 1 nm	Self-calibration with deuterium lines, verification with holmium oxide filter
Wavelength bunching	1 – 400 nm	Programmable in steps of 1 nm
Slit width	1, 2, 4 , 8, 16 nm	Programmable slit
Diode width	< 1 nm	
Flow cell	500 nanoliter: 0.5 µl volume, 10 mm cell path length and 50 bar (725 psi) pressure maximum	

Table 92 Performance Specifications Agilent 1100 Series Diode Array Detector

Type	Specification	Comments
Maximum pressure	50 bar	
Control and data evaluation	Agilent ChemStation for LC	
Analog outputs	Recorder/integrator: 100 mV or 1 V, output range 0.001 – 2 AU, two outputs	
Communications	Controller-area network (CAN), GPIB, RS-232C, APG Remote: ready, start, stop and shut-down signals, LAN optional	
Safety and maintenance	Extensive diagnostics, error detection and display (through control module and ChemStation), leak detection, safe leak handling, leak output signal for shutdown of pumping system. Low voltages in major maintenance areas.	
GLP features	Early maintenance feedback (EMF) for continuous tracking of instrument usage in terms of lamp burn time with user-settable limits and feedback messages. Electronic records of maintenance and errors. Verification of wavelength accuracy with built-in holmium oxide filter.	
Housing	All materials recyclable.	

* ASTM: "Standard Practice for Variable Wavelength Photometric Detectors Used in Liquid Chromatography".

For specification on the 500 nl flow cell refer to Table 85 on page 153.

A
Safety Information

The following general safety precautions must be observed during all phases of operation, service, and repair of this instrument. Failure to comply with these precautions or with specific warnings elsewhere in this manual violates safety standards of design, manufacture, and intended use of the instrument. Agilent Technologies assumes no liability for the customer's failure to comply with these requirements.

General

This is a Safety Class I instrument (provided with terminal for protective earthing) and has been manufactured and tested according to international safety standards.

Operation

Before applying power, comply with the installation section. Additionally the following must be observed.

Do not remove instrument covers when operating. Before the instrument is switched on, all protective earth terminals, extension cords, auto-transformers, and devices connected to it must be connected to a protective earth via a ground socket. Any interruption of the protective earth grounding will cause a potential shock hazard that could result in serious personal injury. Whenever it is likely that the protection has been impaired, the instrument must be made inoperative and be secured against any intended operation.

Make sure that only fuses with the required rated current and of the specified type (normal blow, time delay, and so on) are used for replacement. The use of repaired fuses and the short-circuiting of fuseholders must be avoided.

WARNING **Any adjustment, maintenance, and repair of the opened instrument under voltage is forbidden.**

WARNING **Disconnect the instrument from the line and unplug the power cord before maintenance.**

Do not operate the instrument in the presence of flammable gases or fumes. Operation of any electrical instrument in such an environment constitutes a definite safety hazard.

Do not install substitute parts or make any unauthorized modification to the instrument.

Capacitors inside the instrument may still be charged, even though the instrument has been disconnected from its source of supply. Dangerous voltages, capable of causing serious personal injury, are present in this instrument. Use extreme caution when handling, testing and adjusting.

Safety Symbols

Table 93 shows safety symbols used on the instrument and in the manuals.

Table 93 Safety Symbols

Symbol	Description
	The apparatus is marked with this symbol when the user should refer to the instruction manual in order to protect the apparatus against damage.
	Indicates dangerous voltages.
	Indicates a protected ground terminal.
	Eye damage may result from directly viewing the light produced by the deuterium lamp used in this product. Always turn off the deuterium lamp before opening the metal lamp door on the side of the instrument.

WARNING **A warning alerts you to situations that could cause physical injury or damage to the equipment. Do not proceed beyond a warning until you have fully understood and met the indicated conditions.**

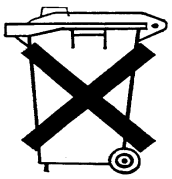
CAUTION A caution alerts you to situations that could cause a possible loss of data. Do not proceed beyond a caution until you have fully understood and met the indicated conditions.

Lithium Batteries Information

WARNING **Danger of explosion if battery is incorrectly replaced. Replace only with the same or equivalent type recommended by the equipment manufacturer. Lithium batteries may not be disposed-off into the domestic waste.**

Transportation of discharged Lithium batteries through carriers regulated by IATA/ICAO, ADR, RID, IMDG is not allowed. Discharged Lithium batteries shall be disposed off locally according to national waste disposal regulations for batteries.

Danish Information:



Lithiumbatteri - Eksplosionsfare ved fejlagtic handtering. Udskiftning ma kun ske med batteri af samme fabrikat og type. Lever det brugte batteri tilbage til leverandoren.

Lithiumbatteri - Eksplosionsfare. Ved udskiftning benyttes kun batteri som anbefalt av apparatfabrikanten. Brukt batteri returneres appararleverandoren.

NOTE Bij dit apparaat zijn batterijen geleverd. Wanneer deze leeg zijn, moet u ze niet weggooien maar inleveren als KCA

Radio Interference

Never use cables other than the ones supplied by Agilent Technologies to ensure proper functionality and compliance with safety or EMC regulations.

Test and Measurement

If test and measurement equipment is operated with equipment unscreened cables and/or used for measurements on open set-ups, the user has to assure that under operating conditions the radio interference limits are still met within the premises.

Sound Emission

Manufacturer's Declaration

This statement is provided to comply with the requirements of the German Sound Emission Directive of 18 January 1991.

This product has a sound pressure emission (at the operator position) < 70 dB.

- Sound Pressure Lp < 70 dB (A)
- At Operator Position
- Normal Operation
- According to ISO 7779:1988/EN 27779/1991 (Type Test)

Solvent Information

Observe the following recommendations on the use of solvents.

Solvents

Brown glass ware can avoid growth of algae.

Always filter solvents, small particles can permanently block the capillaries. Avoid the use of the following steel-corrosive solvents:

- Solutions of alkali halides and their respective acids (for example, lithium iodide, potassium chloride, and so on).

- High concentrations of inorganic acids like nitric acid, sulfuric acid especially at higher temperatures (replace, if your chromatography method allows, by phosphoric acid or phosphate buffer which are less corrosive against stainless steel).
- Halogenated solvents or mixtures which form radicals and/or acids, for example:

  $2CHCl_3 + O_2 \rightarrow 2COCl_2 + 2HCl$

  This reaction, in which stainless steel probably acts as a catalyst, occurs quickly with dried chloroform if the drying process removes the stabilizing alcohol.
- Chromatographic grade ethers, which can contain peroxides (for example, THF, dioxane, di-isopropylether) such ethers should be filtered through dry aluminium oxide which adsorbs the peroxides.
- Solutions of organic acids (acetic acid, formic acid, and so on) in organic solvents. For example, a 1-% solution of acetic acid in methanol will attack steel.
- Solutions containing strong complexing agents (for example, EDTA, ethylene diamine tetra-acetic acid).
- Mixtures of carbon tetrachloride with 2-propanol or THF.
- Avoid the use of alkaline solutions (pH > 8.5) which can attack the fuse silica from the capillaries.

Agilent Technologies on Internet

For the latest information on products and services visit our worldwide web site on the Internet at:

http://www.agilent.com

Select **Products** > **Chemical Analysis**

It will provide also the latest firmware of the Agilent 1100 series modules for download.

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In This Book

This manual contains technical reference information about the Agilent 1100 Series capillary LC system.

The manual describes the following:

- installation,
- optimizing performance,
- diagnostics
- parts and materials,
- available options
- specifications.

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